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The National Planning Committee Series will consist of Reports of the various Sub-Committees, each of which deals with the several aspects of the national life. Each Sub-Committee consists of recognised Experts in the subject; and every Report prepared by them considers all the bearings, implications, and consequences of the subject Together the Series will make a comprehensive outline of an all-embracing National Plan, which, if and when implemented, would revolutionise the conditions of life in this country Though most of the Reports were prepared in 1939-40, each is prefaced by an Introduction showing the place of the subject in the entire Scheme of National Planning, and ended by a Summary of Developments which brings the matter fairly up to date.

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ANIMAL HUSBANDRY & DAIRYING, FISHERIES, AND HORTICULTURE

(Three Reports in one Volume)

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Rural Marketing and Finance
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Woman's Role in Planned Economy
NATIONAL PLANNING, PRINCIPLES & ADMINISTRATION
K. T. Shah.

NATIONAL PLANNING COMMITTEE SERIES
(Reports of Sub-Committees)

ANIMAL HUSBANDRY AND DAIRYING

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NATIONAL PLANNING COMMITTEE

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To
All Those
MEMBERS OF THE NATIONAL PLANNING COMMITTEE
and of
Its Various Sub-Committees
A TRIBUTE OF APPRECIATION

प्रारब्धमुत्तमजना न परित्यजन्ति

PERSONNEL OF THE SUB-COMMITTEE ON ANIMAL HUSBANDRY & DAIRYING

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PREFACE

The National Planning Committee, appointed in 1938, began its work early in 1939. After defining the nature of a National Plan, and determining the nature and scope of the work entrusted to them, the Committee issued an elaborate and comprehensive Questionnaire which was subsequently supplemented by specific details. Twenty-nine Sub-Committees, formed into eight groups, were set up with special terms of reference to deal with all parts and aspects of the national life and work in accordance with a predetermined Plan.

After some unavoidable delay in getting replies to the Questionnaire, the Sub-Committees began their work, and submitted Reports,—some of them Final, some Interim,—which were considered at the Plenary Sessions of the Parent Committee in 1940. Towards the end of that year the Chairman, Pandit Jawaharlal Nehru, was arrested and sentenced to a long term of imprisonment, during which the work of the Committee had necessarily to be suspended.

On his release a year later, hope revived for an intensive resumption of the Committee's work. But th outbreak of war with Japan, the threat to India's own safety, and the hectic march of political events, rendered it impossible to devote any attention to such work at that time. It, therefore, inevitably went into cold storage once again; and remained for the duration of the war.

When at last the War seemed nearing its end, Pandit Jawaharlal Nehru with other leaders was released. The moment seemed again opportune to resume the work of the Planning Committee. Meetings of that Body were held in September and November 1945, when certain more urgent questions, already included in the programme of the National Planning Committee, were given a special precedence. A Priority Committee was appointed to report upon them. Changes and developments occurring during the War had also to be taken into account; and another Committee was appointed to review the general instructions, given six years earlier to the Sub-Committees. Revised instructions were issued to them following the Report of this Sub-Committee; and the Chairmen and Secretaries of the several Sub-Committees were once again requested to revise and bring up to date such of the Reports as had already been submitted—either as final or interim—while those that had not submitted any reports at all were asked to do so at an early date.

As a result, many of the Sub-Committees which had not reported, or had made only an Interim Report, put in their Reports, or finalised them. The Parent Committee has had no chance to review them, and pass resolutions on the same. But the documents are, by themselves, of sufficient value, prepared as they are by experts in each case, to be included in this Series.

The following Table shows the condition of the Sub-Committees' work, and the stage to which the Planning Committee had reached in connection with them.

Serial No.	Name of the Sub-Committee.	Final Report		Interim Report		No Reports
		N.P.C. Resolutions	Not considered by N.P.C.	N. P. C. Resolution	Not considered by the N.P.C.	
Group I	**Agriculture & other Sources of Primary Production**	Handbook Pp		Handbook Pp.		
1	Rural Marketing and Finance	97-99				
2	River Training and Irrigation Part I	83-85				
	” ” ” Part II	113-115				
3.	Soil Conservation and Afforestation	115-119				
4.	Land Policy and Agriculture			139-141		
5.	Animal Husbandry and Dairying	87-89				
6	Crop Planning and Production				do.	do.
7	Horticulture	102-103				
8.	Fisheries					
Group II	**Industries or Secondary Sources of Production**					
1	Rural and Cottage Industries					
2.	Power and Fuel		do			
3.	Chemicals					do.
4	Mining and Metallurgy			77-79		
5	Engineering Industries	75-77		130-133		
6.	Manufacturing Industries		do.			
7.	Industries connected with Scientific Instruments		do.			
Group III	**Human Factor**					
1	Labour	89-92				
2	Population	85-87				
Group IV	**Exchange and Finance**					
1.	Trade					
2.	Public Finance					
3	Currency and Banking			122-126		
4.	Insurance			93-95		
Group V	**Public Utilities**			95-97		
1	Transport					
2.	Communications	126-129		120-122		
Group VI	**Social Services—Health and Housing**					
1.	National Housing					
Group VII	**Education**					
1.	General Education			133-139		
2.	Technical Education				do.	
Group VIII	**Woman's Role in Planned Economy**					

To sum up, fourteen Sub-Committees had made final reports, of which ten have been considered, and Resolutions taken upon them, by the National Planning Committee. Twelve more have presented Interim Reports, of which nine have been considered by the Planning Committee, with Resolutions thereon, while three Sub-Committees have not yet presented any report on the reference made to them.

The idea that all this material, gathered together with the help of some of the best brains in India in the several departments of our national life, should be printed and published was before the Committee from the start. But the interruption caused by the war prevented its realisation. It was once again mooted in 1941; but the moment was not deemed ripe then for such action, partly because the leading spirits in almost every one of the Sub-Committees were unable to devote time and labour to bring their Reports up-to-date; and partly also because war-time restrictions or shortages had made scarcer than ever before the statistics and other facts, which particular sub-committees would need, to bring their work up-to-date. The war-time needs of Government had attracted several of them to work on Government Bodies, Panels, or Committees. For all these reasons it was deemed undesirable that material of this character—valuable as it must be—should be put out in an incomplete, inchoate, obsolete form, which may reflect unfavourably upon Indian capacity for such tasks.

The last four years of the War were thus a period of suspended animation for the National Planning Committee. Even after the end of the war, it has not been feasible, for obvious reasons, for the Planning Committee to resume its work and finalise decisions. Continuous sessions of that body are indispensable for considering and taking decisions on the Sub-Committee reports presented since 1940, and putting all the material into shape, ready for publication, not to mention making its own Report; but the political situation in the country made it impossible. Other conditions, however, are somewhat more favourable than in 1938-39, when the Central Government of the country were all but openly hostile to such attempts. Lest, however, the momentary difficulties make for needless further delay, it was thought advisable by the Chairman and the undersigned that no more time should be lost in putting this material before the Public. Following this advice, it is now proposed to bring out a complete Series of the National Planning Committee's Sub-Committee Reports, which will serve as appendices to the Parent Committee's own Report. The Plan of the proposed enterprise is briefly summarised below.

Every Sub-Committee's Report, which is in a final form and on which the National Planning Committee has itself taken resolutions, will be edited and published, with an Introduction assigning their due importance to the suggestions and recommendations contained in that particular report, its proper place in the over-all National Plan; and following it up, wherever necessary, by a kind of Epilogue, summarising the developments that have taken place during the seven years, during which the work of the Planning Committee had been in suspension.

Those Reports, again, which, though in a final form, have not yet been considered, and no resolutions taken thereon, by the Planning Committee, will also be included in the Series in the form in which they were submitted, with such Introduction and Epilogue to each as may be deemed appropriate. And the same treatment will be applied to Reports which are 'Ad Interim', whether or not the Parent Committee has expressed any opinion on the same. They will be finalised, wherever possible, in the office, with such aid as the Chairman or Secretary of the Sub-Committee may be good enough to render. Sub-Committees finally, which have not submitted any Report at all, —they are very few,—will also find their work similarly dealt with. The essence, in fine, of the scheme is that no avoidable delay will now be suffered to keep the National Planning Committee's work from the public.

Both the Introduction and the Epilogue will be supplied by the undersigned, who would naturally be grateful for such help as he may receive from the personnel of each Sub-Committee concerned. The purpose of these additions is, as already stated, to assign its true place to each such work in the over-all Plan; and to bring up the material in each Report to date, wherever possible.

Not every Sub-Committee's Report is sufficiently large to make, more or less, a volume by itself, of uniform size, for this Series. In such cases two or more Reports will be combined, so as to maintain uniformity of size, get-up, and presentation of the material. The various Reports, it may be added, would not be taken in the order of the classification or grouping originally given by the Planning Committee; nor even of what may be called the intrinsic importance of each subject.

In view of the varying stages at which the several Reports are, for reasons of convenience, it has been thought advisable to take up for printing first those which are final, and on which the Planning Committee has pronounced some resolutions. Printing arrangements have been made with more than one Press, so that two or three Reports may be taken simultaneously and published as soon as possible so that the entire Series may be completed in the course of the year.

Two other Sub-Committees, not included in the list of Sub-Committees given above, were assigned special tasks of (1) preparing the basic ideas of National Planning; and (2) outlining the administrative machinery deemed appropriate for carrying out the Plan. These were unable to function for reasons already explained. The present writer has, however, in his personal capacity, and entirely on his own responsibility, published the "Principles of Planning" which attempt to outline the fundamental aims and ideals of a National Plan. This remains to be considered by the Planning Committee. Similarly, he has also attempted to sketch an administrative machinery and arrangements necessary to give effect to the Plan, when at last it is formulated, and put into execution. Notwithstanding that these two are outside the Scheme outlined in this Preface, they are mentioned to round up the general picture of the arrangements made for publication of the entire work up-to-date of the National Planning Committee and its several Sub-Committees.

The several volumes of Sub-Committee Reports, when published, will be treated as so many appendices to the Report of the parent body, the National Planning Committee. It is impossible to say when that Committee, as a whole, will be able to hold continuous sessions, review and resolve upon Sub-Committee Reports which have not yet been considered, and lay down their basic ideas and governing principles for an all over Plan, applicable to the country, including all the facts of its life, and all items making up the welfare of its people.

The disturbed conditions all over the country, and the Labour unrest that has followed the end of the War has caused unavoidable delays in printing and publishing the several volumes in the Series, which, it is hoped, will be excused.

In the end, a word of acknowledgment is necessary to put on record the aid received by the Editor in the preparation and publication of this Series. All those who are associated in the task,—members of the Parent Committee, or as Chairmen, Secretaries or Members of the various Sub-Committees,—have laboured wholly, honorarily, and consistently striven to give the best that lay in them for the service of the country. Almost all Provincial Governments and some States,—the latter twice in some cases,—have made contributions towards the expenses of this office, which have been acknowledged and accounted for in the Handbooks of the Planning Committee, published earlier. Suitable appreciation of these will be expressed when the Parent Committee makes its own Report. At almost the end of its task, the expenditure needed to edit, compile, and otherwise prepare for the Press, the several Reports, has been financed by a Loan by Messrs. Tata Sons Ltd., which, even when repaid, will not diminish the value of the timely aid, nor the sense of gratitude felt by the undersigned.

Bombay, 1st July 1947. K. T. Shah.

Note:—In the Scheme of this Series, originally given, more than one Report was intended to be included in one volume in some cases. The combinations indicated in the circular, of the 20th of June 1947, had had to be modified as the printing of several Reports proceeded.

When about half the volumes were printed, it was found that that scheme would not give a fairly uniform series. The new arrangement is given on the page facing the title page. Some changes have had to be made in that list e.g., the separation of the two Reports on Public Health and National Housing, intended to be in one volume, are now in separate volumes.

Conversely, only the two Reports on Animal Husbandry and Dairying and on Fisheries were intended to be combined. As now decided, the Report on Horticulture is also included in the same Volume.

Again, the original combination of the Report on Mining and Metallurgy with that on Engineering Industries has been modified. The latter now combined with the Report on Industries Connected with Scientific Instruments, which was originally meant to be a separate volume, while the former is to be itself.

31st January, 1948. K. T. S.

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INTRODUCTION

ANIMAL HUSBANDRY & DAIRYING

Animal Husbandry.

This Sub-Committee was required to consider :—

(*a*) Animal Husbandry, comprising cattle breeding needed for farm labour, transport, and food supply.

(*b*) Fodder for livestock, and animal nutrition;

(*c*) Animal diseases, and elimination of uneconomic stock

(*d*) Dairy products, including milk, butter, ghee, cheese; casein, and products therefrom;

(*e*) Poultry farming;

(*f*) Beekeeping;

and any other questions connected therewith.

In the cattle wealth of the country, we include mainly cows and buffaloes, goats and sheep. Donkeys, mules and horses or camels serve some or all of the purposes that cows, bullocks or buffaloes serve; and so they, too, may well be considered in the same category. It is a universally recognised fact that India has the largest number of cattle in the world. It has been estimated that out of a total cattle wealth in the world of 690 million head, India has about 215 million, or over 31%. This is the largest number per acre of cultivated land, per total area, or per head of human population. The war and the unfavourable years that have followed may have affected the in agreegate some parts ; but the annual replacement by normal increment has not materially altered the grand total, or the relative pressure of the cattle population upon the soil in India. Even the partition of the country has not affected the comparative position of either part in this regard. Though, thus quantitatively speaking, the cattle wealth of India is the largest, qualitatively, i.e. in point of yield of milk or meat, or other products—it is perhaps the poorest in the world. The average yield of milk per cow, for instance, has bean found to be 600–750 lbs, per lactation season, whereas the best yield in India itself is known to be some 6000 lbs. An average of 2000 lbs per animal is thus not too much to expect. Expert estimates put the total annual yield of milk at 23 million tons, of which only 27%, or 6·2 million tons is whole milk. No wonder that the Government of India themselves aim at a target of expansion, in this department alone, in 1944, of at least 300%.* The reason is quite simple. If only the best specimens were kept the yield would increase considerably. Most of the animals are weak, illfed, and therefore, uneconomic to keep. At least 60% of the cattle are aged, barren, diseased or disabled; but the religious sentiment of by far the largest proportion of the people strongly militates against the elimination of such unfit, unserviceable and useless cattle, or their utilisation for food purposes. Large sums are annually spent on Cattle Hospitals or homes, the so-called panjrapoles,-where the barren, disabled or otherwise burdensome cattle are maintained mainly on account of religious sentiment. But this inevitably diminishes the amount of food and general care available for the more useful part; so that, on the whole the yield and utility of the enormous cattle population of the country goes on, instead of improving, progressively, deteriorating. If the amount of food, fodder and care devoted to this 60% of worthless beasts were employed for the benefit of the remainder, the yield of milk, meat, hair, wool, hides, bones, guts and all other animal products would increase disproportionately, so that not only would the present quantity of yield be made up; but a much greater increase provided. It may be added, also that there is little or no specialisation in the use of cattle. All are for all kinds of services that man can get from beast, except, probably for food, for a large section of the people. The bullock or buffalo forms an integral and essential factor in the agrarian economy of the country. He supplies the animal power for ploughing and watering the land as well as for transporting crops. The Cow and the Buffalo supply milk and all milk products, as well as their young for draught or haulage. The multipurpose animal may be highly efficient for no single purpose. Even if we breed multi-purpose type, let us not ignore entirely the value of special breeds for special needs. The aggregate milk production in India is said to be considerable; but, given the high figure of the population, 400 crores, the average consumption of milk per capital is hardly 6 oz. per day,–the lowest in the world. This is an *average*, which means, that more than two-thirds of the population do not get even that figure, perhaps not even half of it; compare this with an estimated optimum consumption of not less than 10 oz. of whole milk per day for a really balanced diet and you can understand the poor nutritive value of Indian diet. More than 75% of the milk produced in the country is, again, it has been officially calculated, utilised for the production of ghee, the commonest fat used in this country. The milk left for consumption as milk, or for conversion into other milk products is thus very much smaller; and so the per-capita share may be taken to be hardly a third of the already very small quantity, being the average available for consumption as milk. There are some 45,000 miles of railway track in India; and some 60,000 miles of metalled, all-weather roadway. But these are insufficient to serve for transport facilities to an area of over 1,500,000 sq. miles comprising over 7,00,000 villages. They are served by cattle transport at all times and in most cases. Given, however, the poor quality, low vitality and weight, as well as a short life tenure, the aggregate energy put forward by this means is comparatively very small.

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* Cp. Memorandum on Development of Agriculture and Animal Hus bandry in India. p. 2.

The main problems, therefore, in regard to the development of the cattle-wealth of India under planned economy are :—

(i) Proper breeding and care after birth of the calves and heifers, so that the numbers of the better quality cattle be increased, and the yield of milk and other products from these animals be raised;

(ii) Feeding of cattle on grass, fodder, concentrates of all kinds, is the next most important task in adding to this form of the country's wealth.

(iii) During their normal span of life, cattle in India are exposed to preventible or curable disease. This does not affect their number, so much as the quality of their work, or yield of their products. Prevention and cure of cattle disease is thus an equally important problem, which the National Planning Authority, if and when it is set up, cannot ignore or postpone.

(iv) The general management of cattle, with due attention to all the problems mentioned above, is not less important for an abiding improvement in this source of our national well-being. It will have to be a special business by itself. The elimination of the useless stock, so as to reduce the needless pressure upon available sources, may well be comprised under this general heading. The establishment and development of large scale mechanised industries, based upon all kinds of cattle products, like milk, meat, hides and skins, and the articles manufactured therefrom, hair, or wool, bones, guts, and the like, takes us to the agricultural and industrial reorganisation of the country as a whole that a comprehensive ·Plan of all-round development must necessarily take into account.

None of these tasks is impossible, or even difficult of attainment, if only there is a comprehensive, scientific plan for all-round development, in every aspect and every item of our national economy.

An official Memorandum on *The Development of Agriculture and Animal Husbandry in India,* issued in 1944 by the Imperial Council of Agricultural Research, has pointed out that :

"Agriculture cannot be considered as an independent entity. Its development is part of the larger problem of rural development, which must be tackled as a whole. It is, for instance, interdependent with industry, the sound expansion of which is indispensable to any comprehensive programme for the advancement of agriculture. It must be considered in relation also to the plans for Commerce, Finance, Health, Education & c. Nor could such a programme be prepared until numerous matters of policy, which affect planning at many stages, have been decided by Government. Further, there are many matters fundamental to development, but concerning which surveys must be conducted, researches be carried out and data be collected, before planning is possible, owing to the inadequacy of existing information."

While this shows the close interdependence of all aspects and items in a planned national economy, so that no single item can be pushed up without resulting in unfavourable reactions upon several others. It also indicates that there is considerable room for attaining the target in each of the tasks mentioned above, on this particular subject of Animal Husbandry and Dairying.

Thus, for instance, there are considerable possibilities for effective, scientific cattle breeding in India. Excellent breeds are known to exist within the country itself, e.g. the Gir, the Kankrej, the Malnad or the Punjab cows, bulls, or the buffaloes. Their proper mating is a matter for the trained stockman, of whom we have no great dearth. Krishna himself is famous as Gopal or the Cowherd; and the numbers of the Gowlies or Bharwars (shepherds) and their traditional skill or knowledge is indisputable.

But if necessary, our immediate local deficit in skill and experience in cattle breeding can be made good by foreign imported Technicians for a term. The study of the cattle wealth, its care and management, should be part of the Veterinary Education and Training in the entire educational programme of the country. A national system of basic education, carried on with the help of suitable crafts can easily attend to this part of the Plan. The cultivation and production of the required types of cattle will then be only a matter of a few years.

A far more difficult task is: adequate and suitable feeding for cattle. As already remarked, the excessive numbers of existing cattle, a greater part of them maintained for reasons of religious sentiment, makes it impossible to give to the really productive and useful cattle their full share of food and nutrition. The poverty of the peasants also stands in the way; the excessive pressure of cultivation for food or cash crops on the land under the plough, its fragmentation into microscopic holdings, scattered over the land, leaves very little room for adequate and appropriate pasturage. This is not really for lack of land to grow fodder crops of a suitable nutritive quality. There is a large area of hillside slopes, which now go all but unattended which can be terraced for cultivation, or at least to provide food for sheep and goats if not also for cows and buffaloes, mules and donkeys, camels and horses. Besides, if only the land under cultivation was better ordered, and tilled under economic holdings; if those holdings, farms, were suitably manured and watered and worked by efficient tools and implements, or power driven machines ample grain crops could be raised which would leave ample green grass or hay for all animals. Diversity in crops can also be arranged to provide more productive cattle-food, in the shape of oilcakes and other concentrates, such goods being preferably reserved for milch-cattle. And if all that is not enough, there is available good culturable land, now lying fallow or out of cultivation for reasons other than any intrinsic lack of the necessary chemical properties and physical qualities of the soil. Such land needs to be brought into cultivation for several reasons of a general National Plan; and so this would be only an item, an integral item, no doubt, in the all-round programme of national development.

The Sub-Committee's Report gives in considerable detail the ways and means and forms of improved feeding for cattle in this country. We need therefore, not go in this place into all those particulars, beyond observing that proper feeding of milch-cattle alone is expected to increase the country's milk supply by 30%. Organization of an adequate Cattle Health Service to guard against preventible cattle diseases, and to treat diseased cattle when such diseases is unavoidable, is a matter for well organised Veterinary Education in the country and a widespread knowledge of the proper treatment of cattle in sickness. There are a number of Veterinary Colleges already at work in the country. But, given the size of the land and the large number of cattle to be attended to, this number will have to be very substantially increased before the health of the cattle in India can be said to be duly attended to. Knowledge of veterinary science and training in the subject cannot be confined only to high grade colleges. Schools, Basic, Secondary, and Technical, will also have to devote attention to this item at least in the rural areas, which means over ¾ of the country. The care and management of the cattle wealth must form no insignificant part of a working farmer's education and equipment. Housing, feeding, watering the cattle as well as breeding and using each for its own proper quality must be understood by everyone daily concerned with the Agrarian economy of the country. Some of these may be specially skilled crafts; and the aid of specialists must, of course, be available to all working agriculturists as and when wanted. But the elements of these matters must be understood by every farmer, whose traditional and hereditory skill must be supplemented by such additions from modern scientific advance as can be conveniently introduced in the agricultural school curriculum.

We have listed above the elimination of unfit cattle under the heading of Management. This may be accomplished in a variety of ways, as the Report shows. Another Report in this Series, that of the Population Sub-committee, suggests a change in the people's food habits, which would have to be preceded by a revolution in religious sentiment, so as to use up the surplus cattle for food. Or, what may amount to the same thing, these, the surplus cattle may be exported to neighbouring countries in need of such wealth. The following statistics, though relating to the quinquennium before the War, is highly instructive, and holds good even to-day as regards the possibility of this means of disposing of the surplus and useless cattle from India.

India's Trade in Animals between 1934-6 and 1938-9.

(Value Figures in thousands of Rs.)

	IMPORTS			EXPORTS			
Year	Animals	Horses	Others	Cattle	Horses	Sheep & Goats	Others
1934-5	Number	3,061	6,360	778	69	47,338	119,510
	Value	28,15	1,79	62	216	8,39	1,07
1935-6	Number	2,041	6.838	407	28	39,912	227,689
	Value	24,21	2,22	32	32	7,23	1,38
1936-7	Number	2,197	7,776	87	16	35,774	180,652
	Value	13,27	2,41	8	22	6,03	1,98
1937-8	Number	3,969	8,008	1848	14	33,465	194,655
	Value	33,30	2,03	1,16	20	6,29	1,33
1938-9	Number	3,210	7,262	1,436	15	30,400	147,028
	Value	28,18	2,54	83	12	6,00	1,27

Though the value may not be considerable, we seem to have been exporting quite a number of small and large animals,—more export than import. On the import side, moreover, the value figures are probably inflated because of the import of high-priced Race Horses, for which there was a great demand. This method, therefore, of liquidating our surplus cattle wealth is not utterly out of the question, notwithstanding the prejudices of a majority of our people.

Castration and ringing of bulls and cows, deemed unsuitable for breeding, may also help, at least to prevent a further increase of unwanted, poor quality cattle. There is no religious prejudice against such practices, so far as cattle are concerned. After, therefore, the present excess of aged, diseased, defective, useless and burdensome animals is wiped off, the process of scientific breeding and proper stock raising of exactly the kind of animals we need would be much more simple and productive. The aggregate wealth would be increased rather than diminished by this process; while the wealth now remaining idle and unproductive in the Panjrapoles and other such institutions for the care of superfluous cattle would be released into more productive channels.

Other forms of animal wealth or products, needed or supplied by India, are given in the following Tables of the Imports and Exports of All Animal Products. The list includes a variety of articles such as wool and woollen goods, like cloth, carpets, blankets and rugs, braids, shawls and worsted goods; bones fish, fish oil, butter, cheese, ghee and other milk products; hair and hair manufactures, manure, guano etc. The figures make a very imposing total.

Imports of Animal Products in the Quinquennium 1934-5 to 1938-39 (*Only Value Figures are given in Lakhs of Rs.*)

ARTICLE		IMPORTS			
(Year)	1934-5	1935-6	1936-7	1937-8	1938-9
Raw Hides & Skins	10.37	10 00	12.03	19.71	16.26
Tanned Hides & Skins	15.05	11.52	12.25	17.77	12.18
Wool & Woollen Products	324.50	222.42	238 24	335.16	227.82
Dairy Products	78.87	85.49	86.22	51.42	54.42
Other Animal Products	46.02	53.46	57.15	32.01	33.61
Grand Total	97.74	409.32	421.58	491.39	375.01

Exports of Animal products in the Quinquennium 1934-5 to 1938-9 (*Only Value Figures are given in Lakhs of Rs.*)

ARTICLE		EXPORTS			
(Year)	1934-5	1935-6	1936-7	1937-8	1938-9
Raw Hides & Skins	312.01	410.08	434.75	493.71	381 12
Tanned Hides & Skins	522.14	520.17	674.10	645.36	475.55
Wool & Woollen Products	219.27	292.56	373.89	372.37	384.95
Dairy Products	16.38	16.99	17.74	34.77	34.09
Other Animal Products	105.55	111.29	140.84	176.83	126.81
General Total	1187.59	1360.35	1649.65	1731.84	1410.74

There is a heavy surplus of exports of Animal products of all kinds. These, however, are raw materials of very profitable industry, averaging some Rs. 15 crores a year—the products of which are imported in very large quantities and values into this country. The raw materials might well remain in the country itself, if the corresponding industries are developed here. Given the plenitude of such raw materials and of needed labour, there is no reason why these industries should not be established, as part of the Plan, in this country. When established they may well be expected to yield goods for consumers of the total value of Rs. 50 to 60 crores a year.

The Dairy Industry itself is capable of expansion for all kinds of milk products and which are to-day all but unknown, or imported into the country. In the quinquennium noted we imported on an average about Rs. 71 lakhs worth of Dairy Products; while we exported during the same period on an average about Rs. 25 lakhs worth of the same goods. This is a needless restriction of a very possible and necessary industry within the country. The Sub-Committee have accordingly recommended that attention should immediately be paid to the establishment and encouragement of all these industries, so that the country's wealth be increased, greater employment found for its labour and capital, and the general standard of living improved.

REPORT OF THE SUB-COMMITTEE

The Sub-Committee on Animal Husbandry and Dairying begs to submit the following Report :—

2 The following five gentlemen were first appointed as members of the Sub-Committee :—

Sir Chunilal V. Mehta, K. C. S. I., Bombay (Chairman).

Dr. B. K. Badami, Director of the Veterinary Department, Hyderabad (Secretary).

Mr. E. J. Bruen, Livestock Expert to the Government of Bombay (Poona),

Rao Bahadur M. R. Ramaswami Sivan, Retired Principal of the Agricultural College, Coimbatore, and Mr. Shah, Director of Veterinary Services, Lahore.

As Dr. Badami had to resign the Secretaryship, Rao Bahadur M. R. Ramaswami Sivan was appointed Secretary. Mr. F. J. Gossip, Livestock Expert, Bengal, Dacca, was later on appointed an additional member of the Sub-Committee; and, in place of Mr. Shah who resigned, Mr. Sar-ud-din, Professor of Animal Husbandry and Dairying, Punjab Veterinary College, Lahore, was co-opted.

3 The first meeting of the sub-committee was held at Bombay on 24th October 1939, the following members attending :-

Sir Chunilal Mehta (Chairman), Mr. M. R. Ramaswami Sivan, Dr. B. K. Badami, Mr. E. J. Bruen and Professor K. T. Shah, General Secretary, and Mr. K. D. Guha, Joint Secretary, of the National Planning Committee, were also present.

4 The need for a long questionnaire was considered unnecessary, in view of the fact, that Government Departments had been working on problems relating to Animal Husbandry and Dairying, and had collected sufficient statistics for the Sub-Committee to carry on. A circular letter was, however, sent to Directors of Agriculture, Directors of Veterinary Services, Livestock Experts and Imperial Experts of the Government of India, and some private individuals, asking for suggestions with regard to points on which the National Planning Committee should concentrate. Replies were received from some persons, each drawing attention to particular aspects of the problem, while some of them sent relevant publications dealing with cattle breeding, dairying, marketing, poultry-keeping, sheep-breeding and bee-keeping (vide Appendix). These replies and publications will be utilised in the preparation of the Report by the Sub-Committee.

Apart from replies received to the circular, several useful communications were received, which are noted in Appendix.

Appendix gives a statement of books, reports, bulletins leaflets and other publications received and consulted.

The response to the circular was, however, not as adequate as one could wish, and the Secretary visited the following places, with a view to obtain first-hand information :—

(i) Palyakottah (Coimbatore) — to see the Cattle Breeding Station (Kangayam breed) belonging to the Pattagar of Palyakottah.

(ii) Bangalore — to see the Imperial Dairy Institute, Bangalore and the City Milk Supply.

(iii) Coimbatore, Cuddalore, Madras -- to study the working of recently started Co-operative Milk Unions.

(iv) Guntur—to see the Government Cattle Farm (Ongole breed).

(v) Nagpur—to study the working of the Telankhery Co-operative Dairy and Poultry Farm.

(vi) Hyderabad - to see the Cattle and Dairy Fram and discuss with Dr. B. K. Badami.

(vii) Poona—to see the Cattle, Dairy and Poultry Farms and discuss with Mr. E. J. Bruen.

(viii) Kandivli-- to see the Gaurakshak Mandli, Bombay (Gir breed).

(ix) Chharodi, Gujerat—to see the Northcote Cattle Farm (Kankrej Breed).

and

(x) Anand—to see Polson's Factory.

The visits to the above places and the personal discussions with the Experts and Managers concerned were very helpfull.

5 It will be noticed that, while information, and sometimes detailed information, has been given in the draft report with regard to some Provinces and Indian States and with regard to particular localities therein, the report may be said to be incomplete in that it has not dealt with problems appertaining to some other Provinces and localities, for the reason that, reliable information was not available and that no communications or publications relating to them were received from them. The general conclusion arrived at in the Report may, however, be said to apply *mutatis mutandis* to all Provinces and States in India.

6. Of the several items of reference to this Sub-Committee mentioned on Page 87 of the Red Pamphlet of the National Planning Committee, most have been dealt with in the draft report. Denifite information is not available with regard to some of the products of animals, namely, hides, horns, hair, bones, guts etc; and a supplimentary report may be prepared at a later date, if necessary.

7. It is well to remember and to recognise that substantial work has already been done and is being done, on Animal Husbandry and Dairying by the following Agencies in India, who have gathered fairly accurate statistics and who have published copious literature on the subject. Reference is invited to the publications and the reports of the Imperial Council of Agricultural Research and of its Advisory Board and of the Animal Husbandry Wing of the Board of Agriculture,

8. The Government of India maintains the Imperial Agricultural Research Institute at Delhi, the Imperial Dairy Institute at Bangalore, the Imperial Veterinary Research Institute at Muktesar and the Imperial Animal Nutrition Institute at Izatnagar, all manned by superior, well-trained Research staff. There is the Imperial Council of Agricultural Research at Delhi, with special experts for Animal Husbandry and Marketing, with its Fodder and Grazing Sub-Committee and the Animal Husbandry Wing of the Board of Agriculture. Apart from Conferences of Ministers of Agriculture from the Provinces the deliberation of matters of policy and administrative problems, the Government of India hold, from time to time, for technical purposes, meetings of the Animal Husbandry Wing, the Fodder and Grazing Committee, the Marketing Committee etc. and organise Cattle Conferences and Cattle Shows, Ghee Conferences, Poultry Conferences and Poultry Shows. The reports of Sir John Russel and Dr. Wright have become the basis for future work in India.

9. **Provincial Government and Indian States:**—The Provincial Governments and the Governments of several Indian States have substantially added to the stock of knowledge in

Animal Husbandry and Dairying in India, through their Directors of Agriculture and of Veterinary Services, their Livestock Experts, their Provincial Marketing Officers and their Fodder and Grazing Committees. They have their own Livestock Research Stations for cattle, sheep, goats, poultry and bee-keeping, and all agricultural Colleges maintain a cattle and Dairy Farm and a Poultry Yard.

10. There are several Co-operative agencies working all over the country in this subject. Special mention may be made of producers' societies, the best example of which is the Cooperative Dairy run by Gaolies at Nagpur.

11. There are private concerns who have taken up cattle breeding, and mention may be made here of the Pattagar of Palayakottah, who breeds the pure Kangayam breed, the draught cattle of South India, and of the Gaurakshak Mandli of Kandivli dealing with the Gir breed, one of the well known milk breeds of Bombay. There are also professional hereditary breeders such as the Lambardas and Dhangars of the Deccan and Central India, the Rabaries and Bharwars of Gujerat and Kathiawar and the Jats and others in the North. Mention may also be made of grantee farmers of the Punjab.

12. Aims of Planning:

As with all other industries, planning with regard to Animal Husbandry and Dairying should aim, in its broadest aspects (i) at making India self-sufficient for all its requirements, and (ii)at adding to the wealth of the country, and improving the economic conidtions of the people, of *the masses in particular*. For this purpose it is necessary to improve breeds, to produce more milk and milk products in the country and to lessen the cost of production to such an extent that all classes of people will consume more milk and milk products and will thereby attain a higher standard of health.

13, (A) Animal Husbandry:

Under the heading of Animal Husbandry, the following points require consideration:

(i) To evolve better breeds of all kinds of Livestock — cows, bulls, buffaloes, sheep, goats, poultry, etc.;

(ii) to improve the present Livestock by selection either with the stock available in the locality or by transport from one part of the country to another;

(iii) to evolve pedigree breeds of cattle or what are known as general utility animals for the dual purposes of milk and draught, or for milk or draught where conditions require them.

(iv) to provide for the care and disposal of surplus stock;

(v) to suggest suitable salvage operation, including the licensing of animals for the slaughter-house;

(vi) to provide for immediate treatment of animals in disease and prevent the spread of contagious diseases.

(vii) to make proposals for:

(*a*) adequate pasture;

(*b*) provision of grazing areas by demarcation or low jungle and other forest areas and of poramboke waste lands, grazing to be allowed under controlled conditions;

(*c*) providing facilities for growing fodder crops under irrigation, and extending Government concession from payment of land assessment and water rate, in areas devoted to the growth of fodder crops only;

(*d*) storage of dry fodder as straw, hay or ensilage, to ensure adequate supply of roughage in seasons of drought and famine.

(*e*) provision of adequate quantities of all kinds of concentrated food;

(viii) to evolve breeds of sheep for better wool-producing capacity;

(ix) to evolve suitable breeds of goats to add to the milk supply of villages;

(x) to evolve better breeds of poultry for their egg-laying capacity;

and (xi) to organise bee-keeping as a Cottage Industry in localities where food for the bees is available throughout the year.

14 As regards Dairying proper, the following points require detailed consideration :—

(i) to increase milk production in the country, and at the same time, lesson the cost of production;

(ii) to maintain and distribute pedigree herds;

(iii) to suggest improved and hygienic methods of handling milk and milk products;

(iv) to indicate the products in which the processing of milk must be done;

(v) the manufacture of butter :—

  (a) by separation of cream and,

  (b) by the Desi method from fermented whole-milk or curd;

(vi) the manufacture of ghee :—

  (a) with the help of cream separator;

or

  (b) directly from fermented whole-milk or curd

(vii) utilisation of separated milk and butter-milk;

(viii) manufacture of by-products—kinds, possibility and limitations;

(ix) desirability and possibilities of starting Dairy Manufacture on a Factory scale;

(x) providing facilities for transport of milk from villages to collecting centres, and from collecting centres, to urban areas;

and

(xi) co-operative methods applied to all aspects of Dairying: the evolving of pedigree animals; collecting, handling, transporting and distribution of milk and milk-products; the manufacture of butter, ghee and other milk products; and co-operative marketing.

15. Cattle breeding and Dairy Farming as such are not practised largely in India, with the exception of some hereditary breeders, referred to in para 11. Villagers own some working cattle and one or two cows and she-buffaloes for consumption of milk by the family, and for sale of surplus milk or ghee. Agriculture and the growth of crops are their main concern. If cattle can be made an economic proposition, the cultivator's interest in cattle-breeding will be stimulated; and it will become a valuable subsidiary occupation to his main business of agriculture which is by no means always paying. Better breeds of milch animals will add to his income by increased yield of milk and milk-products; and stronger working animals will help in ploughing and draught requirements; it is, therefore, to his advantage that he should have well-bred and well-fed livestock attached to his household.

16. **Cattle in India**

The world's cattle population, according to a recent estimate, comes to about 690 million animals. Indian cattle are estimated at 215 millions. India has thus the largest cattle population in the world. Animal Husbandry is, however, not receiving anything like the attention it deserves, compared with other countries. The village cattle are non-descript, weak, puny animals, easily susceptible to diseases, especially epidemics. They are uneconomical to keep, and their superfluous numbers form a big drain on the fodder resources of the country. One reason often advanced for this state of things is that the villager is sure of some cattle being left over for his agricultural work, even if a good number of animals die in epidemics, and during famine years. There has been no restriction on the cattle population, inferior bulls being allowed to roam about in the midst of village cows, covering the cows indiscriminately, and consuming the scanty grass the village grazing can afford. As regards famines, it is to be hoped that, with planned Economy, their incidence will be very severely minimised.

17. Cross Breeding

Attempts have been made in the past, especially with the object of increasing milk quality, to introduce cross breeding with imported, recognised breeds. The results have been fairly successful in the early generation; but subsequent progeny usually developed disease. Cross breeding with foreign breeds is, therefore, not recommended.

18. Indigenous Good Breeds

It is a matter of some gratification, however, that, in the midst of the promiscuous breeding and multiplication, which have been in vogue so far, there are still left in the country indigenous breeds of good draught and milk capacities, in several tracts, all over the country. These may be said to have survived the onslaughts of famine and pestilence, and, when properly protected, may be considered as immune from disease. Future breeds of cattle must be built up from those surviving good breeds.

19 As far as possible, breeding should be confined to the superior cattle of a particular locality. It may be necessary now and then to draft bulls, and sometimes cows, from one locality to another, but it would be prudent to import cattle from localities which have similar climatic conditions. Grading up present cattle is a difficult and slow process, but it has to be persevered in for several decades. Instead of attempting experiments all over the country at the same time, it may be desirable to concentrate in a few selected villages, and gradually expand as more breeding bulls become available.

20. Brahmani Bulls

The art of good breeding was not unknown in India in ancient times. Good bulls, perfectly proportioned and possessing all the essential points recognised as important in the sires, were selected in the past and dedicated to temples, at the time of certain religious rites, by the members of the Village Panchayats. There is no selection for its breeding qualities in these days when a bull is dedicated. Usually a non-descript, puny, little bull calf is purchased for a very small sum, branded, and let loose in the village. It would be an advantage if the village panchayats realise their responsibilities and help to select suitable bull calves whenever there has to be a dedication of bulls, under the supervision of the Government authority.

21. There has been considerable difference of opinion regarding the objective with which breeding operations have to be conducted. Some are of opinion that, as the country is in need of more milk and milk-products, the evolution of *milch cattle* should be most prominent. Others contend that the villager is in need of cattle for agricultural operations, and that the production of *draught animals* is more important. Fortunately we have special milch breeds and special draught animals. Without upsetting the economy of production of pure milch cattle and of pure draught animals, it is possible to produce what may be termed *general purpose animals.* Milch cattle and draught animals are each important in their own way, and must be bred to type; at the same time, more attention must be paid to produce animals which will serve the dual purpose of milk and draught. Such general purpose animals have been successfully bred in some Provinces and Indian States.

22. The one important point which the Sub-Committee have always kept before their view is the fact that Indian Agriculture requires a large number of bulls and bullocks, both for the purpose of cultivation and road transport. We have attempted to keep in mind the necessity for encouraging what is known as the dual purpose, or the general utility, animal, so that both cow and the bull can perform their respective functions in Planned Economy, with the result that both the animals will be fair and taken care of in a proper manner. We have, however, come up against the difficulties that, in certain areas which are not suitable for bulls and bullocks, or where they are required for draught, cows give no more than a very limited quantity of milk. Under such circumstances the cows in these areas must remain poor milkers and consequently an economic liability. It is possible that by the provision of better road facilities, by the increase of motor transport and railway transport, the requirements of the

cultivator for specialised draught animals may be lessened may then be possible to embark upon this policy of evol the general utility animal. The Sub-Committee recomn that the requirements of each particular graft shoul carefully studied, keeping the above plan in mind.

23. The Sub-Committee considered the question o competition of the cow and the buffalo. The conditions of In agriculture require a supply of bulls and bullocks for cult tion as well as for transport. There is also an in-born se ment in favour of the cow. But so long as the cow continue be neglected and ill-fed, she will never be able to com with the buffalo as a milk producer, either with regard to quantity of milk or its butter value. It is, no doubt, true t in the present conditions of the gross neglect of the cow, s easily beaten by the buffalo. But it has been proved that w proper attention has been paid to the cow and its mil capacity by better breeding and feeding, she has been abl give a quantity of milk which compares favourably with of the average buffalo. The butter content of the cow's milk been raised as much as 5 to 5·6 per cent. It is also worth remark that if the number and the length of lactation of two animals are taken into consideration, it will be found t the milking period of the cow during its life is longer than t of the buffalo. It is also believed by the public on g authority that cow's milk is better for human consumption especially for the young and the weak. A buffalo, on the o hand, while she is a good producer of milk, consumes a la quantity of food, and her male progeny is useless, except; c in certain cases where the male buffalo is used for cultivat But generally it is found that the male progeny of the buf is, if not actually killed, allowed to die of starvation. This state of things which is both inhuman and economic unsound; for a poor country cannot afford to maintain breed for milk and another for cultivation. This Su Committee recommends, therefore, that the cow shoul concentrated upon as the producer, both of the bull and bullock required for cultivation, and of the milk for hu consumption. In those grafts where it is not possible to re these objects, the buffalo may be suitably attended to.

24. Care of Breeding Bulls

While good cows are important in breeding, it must be borne in mind that breeding bulls set the stamp on the future progeny. These breeding bulls must be carefully and specially selected for their good points, and must be properly fed with sufficient quantities of suitable concentrates and roughage; and there should be a limit to the number of services in a year, as otherwise they will lose condition. Light work on the farm is helpful in preventing breeding bulls from getting flabby, with undue accumulation of fat. Whenever breeding bulls are maintained, it is essential that herd registers in approved form should be maintained, and it must be easy to trace pedigree animals, which should, therefore. be specifically marked. Young bulls and he-buffaloes should not be used for breeding before they are three or four years old, and the number of services should be limited, until after they are five years old, when the services may go up to about 70 per annum.

25. It is primarily the function of government to open cattle breeding farms in suitable tracts in the country for the purpose of producing pedigree bulls and cows. This work cannot be undertaken by private effort. The sub-committee would stress this as the function of the State, and recommends that sufficient funds should be made available for the purpose.

26. The Government should devote its energies and resources to the improvement of the milking capacity of the cows by the introduction of good milch cows like the Gir, etc., and by providing facilities for the crossing of village cattle by selected bulls. In special tracts, like the rice growing tracts of the Konkan, buffaloes give good milk, and form an important portion of draught animals. In such cases, the buffalo should be regarded as a dual purpose animal and receive similar encouragement. In other cases, where the cow gives poor milk, she should be bred up so that she can become economical and compete favourably with the buffaloes.

27. The sub-committee wishes to point out that cattle breeding cannot be conducted everywhere. There are areas in each Province that are more suitable to produce economically

good cattle, and there are other parts which are not suitable for breeding, or where the people have no inclination to take up cattle breeding. Each province should, therefore, make a preliminary survey to determine the localities suitable for breeding, and should concentrate future operation in such localities. In other words, economically sound animals can be produced only in certain areas, and only where the people have a keen desire to take up animal breeding.

28. Facilities for Professional Hereditary Breeders

The Committee would like to point out that the professional hereditary breeders all over the country have been the back-bone of the supply of cattle for generations. They have acquired an amount of knowledge and experience which are most useful for cattle breeding. We are constrained to point out that, with the growth of population and the pressure of cultivation upon forest and open areas, the facilities hitherto enjoyed by these breeders are being diminished and their number is slowly decreasing. While they are performing useful service to the country, it would be necessary to study their special requirements; and to give them such facilities with regard to grazing or with regard to colonisation, as may be required, or scientific aid.

29. There are private breeders ; but they are very few. Appendix (I) describes the work done by the Pattagar of Palayakottah in South India.

30. The remarks made in the above paragraphs apply *mutatis mutandis* to buffaloes. Buffaloes in several parts of the country are comparatively small, decrepit animals; but there are still superior breeds in India, of excellent milking capacity, like the Delhi buffaloes, Jaffarabadi, Soorti, etc. They are even better milkers than cows. They are coarse feeders compared to cows, and can subsist in areas where cows will not thrive. Breeding of buffaloes of recognised milking capacity should be encouraged in suitable parts of the country. Animals producing, generally, larger quantity of milk with a higher percentage of fat are so far the better animals in India for manufacture of butter and ghee, and for dairy purposes in

general, The he-buffaloes are used in the cultivation of paddy lands and heavy draught purposes in country roads. It is not an uncommon feature that buffalo she-calves and cattle he-calves are better fed and looked after than buffalo he-calves and cattle she-calves, because economically the she-buffalo and the bull are more useful to the villager. It must be admitted that male and female calves of both buffaloes and cows require equal attention.

31. In his address delivered at the recent Indian Science Congress at Madras on Animal Husbandry, Dr. Haddow reviews the present position of the livestock in India, and points out how far disease and famine have been responsible for the deterioration of all kinds of livestock. While the serum-simultaneous-inoculation method and the goat-virus method have been successful, the epizootiology of the disease has not been fully studied, owing to want of trained staff. He points out the need for researches in the diagnosis and treatment of all diseases-virus, bacterial and protozoon. He states that the low protein content of cattle-food is responsible for the deterioration of animals, and for their inability to resist disease. Dr. Haddow points out the lack of adequate research work on sheep and goat, and pleads for an increased knowledge of gene tics as essential for evolving the essential and desired characters in all kinds of livestock,

32. **Control of cattle disease**

98, 746 animals died from contagious diseases during the last 6 years in Bombay, of which 60,309 due to deaths from Rinderpest only. The control of epidemic diseases is a necessary adjunct to the improvement of Livestock in the country, and the Director of Civil Veterinary Services should be given more staff and resources for the purpose. Compulsory vaccination and examination of cattle at Provincial boundaries will restrict the importation of cattle diseases into the Province from outside. Movement of cattle in villages or areas which are infected should be completely checked. Compulsory vaccination should be adopted in areas receiving Government assistance for cattle improvement.

33. It may be considered an advantage if useless surplus stock is disposed of. But the fact remains that good animals, otherwise economically useful for draught and milk purposes, are also slaughtered, especially in cities, causing a serious economic drain to the country. What should be aimed at is to prevent the slaughter of good animals of recognised breeds which have a future usefulness for breeding and milk production. The enormity of this slaughter can be exemplified from the figures recently collected in Bombay City. 16,635 bullocks, 33,316 cows and 18,019 she-buffaloes of different ages were slaughtered in the Bombay Municipal slaughter-houses at Bandra and Kurla during the year 1938-39. No he-buffaloes were killed. The staughter of useful milch cattle is a direct result of the existing system of city dairy stables. An alteration of this system in favour of milk production outside city limits is the first step to be taken for the protection of milch animals, and for a satisfactory, indigenous Dairy Industry. It is essential that Government and Municipalities should establish Dairy areas outside cities, where milk producers can milk, breed, and rear milch stock, and maintain dry animals as well.

34. Legislation is essential for the licensing of each slaughter-house, where a qualified Veterinary Officer should be on full duty during working hours. Such officer may also be entrusted with meat inspection and with the issue of certificates for hides and skins. Separate officers should be appointed for milk inspection. Slaughter of animals of scheduled breeds should be absolutely prohibited unless certified as unsuitable for further use. The duty of deciding what animals can be admitted into a slaughter-house should devolve upon the Veterinary Officer, who should have detailed instructions for the purpose, and who should be responsible to prevent unnecssary and undesirable slaughter.

35. Railway authorities should give wide concession on freights for removal of dry milch animals from the city to rural areas, and, if necessary, to enhance railway freight on milch cattle brought from rural areas to towns.

36 Government should arrange for the protection of these dry animals by taking them to rural areas; or the work should be entrusted to, and undertaken by, private Cow Protection Societies, who urge the prevention of slaughter. If dry animals are retained in cities, encouragement will be given to gaolies to prolong the milk period by cruel mal-practices like phooka, with the result, that the animals will be irretrievably ruined for ever. The problem relates principally to cities, as much slaughter is not noticeable in village parts. It has been noticed that there is a great mortality amongst calves in cities, and these calves can be saved by artificial feeding with skim milk and gruel, and by removing them in time to village areas.

37. The production of milk in large cities is closely connected with the slaughter of useful cattle. The slaughter of dry cows, and buffaloes and the premature death of calves in cities is largely an economic question, in that it would not pay cattle owners in cities to feed and rear dry animals by keeping them in cities; and that the goalies would want all the milk of the cows, and could not afford to give even two pounds of milk to the calves. The alternative is that Provincial Governments and Municipalities should prohibit the keeping of milch cattle in cities, and should provide suitable land near towns and cities where the city milk supply can be produced, and where the cattle can live a natural and cheaper existence. Such land, if situated in the command of Canals, will be ideal; failing this, good land, irrigable by wells, will meet the case.

38. There is a strong sentiment in the country against slaughter of animals, and for providing institutions like PINJRAPOLE for taking care of the old and infirm cattle. Large sums of money are being subscribed through commercial agencies in the shape of cess for the maintenance of these institutions which are spread all over the country. It is true that India possesses, perhaps, the largest cattle population in the world, Unfortunately the majority of these cattle are uneconomic, and, in fact, encroach upon the fodder supply required for the healthy animals. The only way by which slaughter can be prevented is making the animal an economic proposition, so that it would be taken proper care of by the owner and the cultivator

It is quite possible to utilise some of the funds of the institutions mentioned above for the purpose of cattle breeding. So long as the sentiment in favour of making provision for the old and infirm cattle exists, part of the funds of this institution may be utilised for maintaining the pinjrapoles; but a part ought to be set apart for the purpose of cattle breeding. That it is possible to do so has been proved by the experience of the Bombay Gowrakshak Mandal and the Bombay Pinjrapole. We recommend that provincial governments should examine the individual local conditions, and take such action on the above lines as may be neccessary.

39. **Castration**

Unless useless bulls are castrated, the work of improving Animal Husbandry will be unsatisfactory. With the new process of vein crushing objection to castration is disappearing. Attention may be invited to the enactment of the *Bombay Livestock Improvement Act*, whereby provision has been made for compulsory castration of useless bulls in certain tracts of the Bombay Presidency; but results have been disappointing because the initiative has been left to local bodies. The provisions of the Act may be stiffened with advantage. It is satisfactory to note that a Bill is being introduced in Madras on the lines of the Bombay Livestock Improvement Act. We recommend the introduction of similar acts in all Provinces and Indian States. It may be mentioned that similar work has been done in several villages of the Bhavanager State.

40. International convention demands that skins and hides, meant for export, should be examined and certified by proper authority as being free from contamination from infectious diseases. Regarding export of skins and hides, tanners and shippers should be consulted. Measures should be undertaken by Government to regulate quarantine and transport of animals from one country to another. The value of skins and hides is much reduced by the branding of animals on the hips. It is recommended that branding may be done on the cheeks of animals and individual identification secured by tattooing on the back of the ear.

41. Co-operation

For the solution of problems connected with Animal Husbandry and Dairying in India, particular attention may be paid to Co-operation,—cooperation organized from the bottom and not superimposed from the top, and emanating from the desire of the villager to co-operate, and not thrust upon him by well-meaning officers of Government. The Co-operative Departments all over India have been more largely interesting themselves hitherto: in organizations for credit; and, only recently, some attention is being paid to Co-operative Production Societies, Marketing Societies and Consumers' Societies. The attention of the National Planning Committee is invited to (*a*) the working of some Co-operative Dairy Societies in India, (*b*) the working of the co-operative system as followed in Denmark, which will be taken as a typical example, and (*c*) the future lines of developments of co-operative organisations in India, as envisaged by the Bombay Expert Cattle Committee. Of the Co-operative Societies in India, mention may be made of: –

(i) the Telankhery Co-operative Dairy Society of Nagpur;
(ii) the Calcutta Milk Supply Union;
(iii) the Lucknow Milk Supply Union; and,
(iv) some Milk Unions of the Madras Presidency.

Detailed particulars will be found in Appendix (II) regarding these, as also a description of co-operation in Denmark

42. Adulteration of Milk

The Co-operative Society and other honest vendors may take all possible care and send genuine milk in sealed cans. But instances have been reported of unscrupulous hawkers using their ingenuity to adulterate the milk with water, without disturbing the seal, whereby the good name of the Society is endangered. A precautionary measure is suggested. The Society may affix a label on each can stating that the specific gravity of cow's milk is higher than that of buffalo's milk, and skim-milk is heavier than cow's milk. The specific gravity is liable to vary, from day to day, according to the breed of the animal, the nature of fodder, the month of lactation; and also between the first drawn and last drawn milk from the udder. When the milk of several cows is mixed up before pouring into the milk cans, the specific gravity will, more or less, be constant, say, 1030 for the cow's milk, and 1025 for the buffalo's milk. The consumer can test the delivered milk with a Lactometer, and notify the Society if there is disparity in the Lactometer Reading,

43. Regarding cow's milk or any milk, to be consumed in quantities desired by the public, it is essential that pure supply is secured. But the distribution of pure milk is even more important. The Committee is very strongly of the opinion that unless fhe Food and Drugs Act is rigidly applied to municipalities and local bodies, and severe penalties imposed upon adulteration, the producer of good milk will always be defeated by the unscrupulous middleman or hawker; and he will not get reasonable price for his pure milk. Propaganda for more consumption of milk should be preceded by reasonable guarantee that pure milk will be supplied to the public.

44. The question of Containers, whether, they are for milk, butter, ghee or other milk products, may appear to be a small matter; but it is best that some attention is paid to design suitable containers of different capacities, of standard pattern, for different purposes, with a view to ensure sanitary storage and to prevent fraud and adulteration. The names of the producers should be noted on labels attached to the containers, so as to fix responsibility for the genuineness of the article contained on the producers.

Animal Husbandry Wing of the Board of Agriculture in India

45. The attention of the National Planning Committee is invited to the proceedings of the third meeting of the Animal Husbandry Wing, convened under the auspices of the Imperial Council of Agricultural Research, in February 1939, and to the recommendations made therein. The Ministers of Agriculture from Provincial Governments and Indian States and their technical experts met at a conference held at Simla in

May 1937 to discuss matters of policy relating to cattle improvement in India, and passed a number of resolutions, which were later on sent to the Animal Husbandry Wing of the Board of Agriculture for detailed consideration and report.

46. The first resolution was that, in response to His Excellency's appeal for provision of funds for the purchase and maintenance of breeding bulls in a sustained manner, and with a continuity of policy for improving Indian Livestock.

(i) There should be, in each Province, a Provincial Livestock Improvement Fund, including donations and Government grants, for use in the improvement of stock within the district, wherein the amount was collected;

(ii) The Central Government should make a substantial grant to the Provincial Funds;

(iii) A Livestock Improvement Board should be set up in each Province and State, with local and district branches;

(iv) The Ministers should be closely associated with the work of the Improvement Board and the administration of the Improvement Funds; and

(v) suitable arrangements should be made for the maintenance of the Breeding Bulls.

47. The second resolution was that, with a view to secure systematic and progressive improvements in grazing areas, and in the conversion of waste lands into grazing areas.

(i) There should be set up, in each Province, a Provincial Fodder and Grazing Committee;

(ii) The Central Fodder and Grazing Committee at Delhi should be in touch with the Provincial Fodder and Grazing Committees.

(iii) Forests and waste lands meant for grazing should be controlled regarding periods of grazing, and the number of cattle admitted to the grazing area, as control of grazing areas was essential for producing hardy, young stock, and as the poorest cattle were found in areas where grazing was unrestricted; and

(iv) Definite schemes of experimental work must be ensured by the Central and Provincial Fodder and Grazing Committees, and by the Forest Departments.

48. The third resolution was that there sould be an independent Livestock Section, and a Livestock Expert in each Province; and that arrangements should be made to train adequate staff of supervisors and stockmen to work under him.

49. It was also resolved that the touring Veterinary staff, entrusted with the duty of taking preventive measures against epidemics in village areas, should render substantial assistance in Livestock improvement work.

50. Another resolution was that, in all crop planning experiments, production of fodder crops should find an important place; and that an intensive system of cultivation of fodder under irrigation should be encouraged.

51. It was also resolved that the Minister for Agriculture should have control of Plant Husbandry, Animal Husbandry, Veterinary, Marketing and Rural Co-operation Departments, each working under suitable technical heads.

52. The above resolutions, adopted at the Ministers' Conference, were ·circulated to all Provinces and Indian States, and the action taken in each Province and State was revised at the third meeting of the Animal Husbandry Wing held at Delhi in February 1939. It was ascertained that most Provinces and States had already taken action in some of the above directions; and that it was in contemplation to take full action in the near future. It is worth while pointing out that, quite recently, the Government of Madras appointed a Livestock Improvement Committee consisting of officials and non-officials.

53. The Sub-Committee on Animal Husbandry and Dairying, of the National Planning Committee, agrees with all the above resolutions and would like to emphasise that speedy and immediate action should be taken by all the Governments and States.

Dr. Wright's Report

54. Dr. Wright's report on the improvement of Animal Husbandry and Dairying in India was issued only three years ago; and the Sub-Committee invites the attention of the National Planning Committee to this report (vide Appendix). He has drawn freely—and rightly too—from the report of the Royal Commission on Agriculture in India, in his findings and recommendations, with regard to which action is being taken by all Governments. The Sub-Committee agrees with his recommendations regarding the necessity for the grading up of the present cattle by better breeding with selected indigenous animals, for the production of pedigree animals, for distribution to the villagers, for the carrying on of researches on animal nutrition, and for doing propaganda amongst the villagers in the clean handling of milk and milk products. He suggests that a new Dairy Research Institute, within easy distance of Delhi, should be started, for specialised research work on Dairy Bacteriology, Dairy Chemistry, Dairy Technology and Dairy Husbandry, utilising the present Imperial Dairy Institute at Banglore, and the proposed Creamery and Research Institute at Anand as sub-stations; and that the investigations of dairy problems should be taken up simultaneously in all Agricultural Colleges, which should be expanded so as to undertake the teaching of the A. D D. course. The importance of ghee in the Indian dietary, to which Dr. Wright makes reference, is realised. But the Committee wishes to point out that there is need and also scope in several localities for the manufacture of several by-products which are now imported into the country.

55. The attention of the National Planning Committee is invited to the Report of the Expert Cattle Committee of Bombay (vide appendix) which deals, in a practical manner, with the lines on which the problems of Animal Husbandry and Dairying can be tackled.

The Expert Cattle Committee was set up by the Bombay Congress Ministry a few months before it resigned. Its term of reference are similar to those issued by the National Planning Committee, and the finding of the Committee, though particularly referring to the Bombay Presidency, are generally applicable to all provinces and states, who may, with advantage, set up similar committees to make recommendations, suitable to particular local conditions.

56. The Committee makes definite proposals for breeding of different types of animals for different parts of the presidency,—commercial dairy cattle, essential draught animals, dual purpose animals, commercial dairy buffaloes, etc. While the Government is expected to start breeding in a number of centres with a view to produce pedigree animals for distribution, a practical scheme for cattle breeding and milk production on co-operative lines is also suggested, starting with village societies, consisting of a group of 5 villages, and capable of supplying no less than 3000 lbs. of milk daily. An affiliation of these societies to rural creamery centres is suggested, which should undertake the collecting, processing and distribution of milk to urban areas. The co-operative society will supply selected breeding bulls to the villages, and help in purchasing selected cows of good milch capacity. When there is surplus milk, the rural creameries should undertake the manufacture of milk products, like skim milk powder, for which there is scope in certain localities.

Principles of Animal Nutrition and the Freeding of Cows & Calves

57. The food of cattle consists of roughage and concentrates. As cattle have four stomachs and are accustomed to chew the cud, they require considerable amount of bulky food. This bulky food or roughage may consist of grass, green fodder, straw, hay or ensilage.

58. **Grass** is nature's provision as food for Livestock, and may be said to contain the necessary food constituents in a more or less balanced ratio for growth. A detailed scientific study of the different kinds of grass, growing in grazing areas and forests, and a determination of their relative nutritive values, is essential, and must be undertaken in Government Institutions.

59. **Green fodder** consists of agricultural crops, cereals like Jowed (Sorghums), maize and Oats or pulses like lucerne, bersee and sunu hemp or special grasses like Guinea grass, Napier grass and elephant grass. They are usually grown under irrigation and several cuttings are obtained in a year, and the fodder must be out at the time of flowering or just before flowering, as the nutrients will be translocated to the seeds, if the plants are allowed to ripen. A certain quantity of green fodder is essential for milch cows, and it is advantageous to add a small quantity of the more nutritious leguminous fodder to the usually supplied cereal fodder. One of the essential points to be noted by a dairy farmer is to allocate a portion of his holding in the village to the growth of fodder under irrigation, and he will find that, in the long run, it is the cheapest food for his cattle.

60. **Straw**: Consists of the dried stems and leaves of cereals, left over after the grain is harvested, and, as the plant nutrients have largely concentrated, during the ripening period, in the grain, straw is the least nutritious of the roughage given to cattle. Paddy straw and Jonna straw are the straws usually stacked in rural tracts.

61. **Hay**: Consists of natural grasses, cut in grazing areas, or of artificially irrigated fodder, dried in the sun, and stored as hay stacks. Great care must be taken to cut the grass before it runs to seed. But it is sometimes inconvenient for the villager to do so, as the agricultural harvesting season coincides with the grass cutting stage, and, as the harvest of agricultural crops cannot be delayed, it is best to cut the grass earlier. Hay making can be done when the weather is fine and the sun is hot. The drying may be hastened, and to a certain extent, controlled, by stacking the green fodder or the grass on sloping bamboo frames kept in wedge-shaped form or tripods, spaced by poles. The preservation of hay in hay stalks is the best and cheapest method of storing roughage for cattle for use in times of draught and famine.

62. **Ensilage**: When weather conditions do not admit of hay-making, all edible green grass and fodder are stored in deep pits or specially constructed silos and kept covered up for

some months. A certain amount of fermentation sets in, producing *sweet or sour ensilage*, much relished by cattle. There is a small amount of wastage on the outsides of the silos. Fermentation is produced by the joint action of water and air. In hay-making, fermentation is arrested by the exclusion of water, and in ensilage making, by exclusion, often times partial exclusion, of air; and a succulent roughage is the result.

Concentrates consist of edible oil cakes, the husks of pulses and the brands of cereal grains; and are valued for their contents of protein, fat, carbo-hydrates and crude fibre. The feeding with concentrates is regulated by milk supply and requires adequate attention.

63. **Nutritive ratios:** Foods are valued by the relative proportions of protein, fat, and carbo-hydrates contained there in, and the *nutritive ratio* (N. R.) is represented by the formula,

$$\frac{\text{digestible proteins}}{\text{Digestible fat} \times 2.3 \text{ plus digestible carbo-hydrates.}}$$

Milk, the perfect food for growth, has a N. R. of I:4. Some of the concentrates, like groundnut cake, have a very narrow N. R; while others, like brans, have comparatively a wider N. R. Bulky fodders have a wide N. R. and have, therefore, the poorest nutritive value. The nature of concentrates and fodder fed to animals will naturally depend on their availability in each locality and the cheapness of cost thereof. When a mixed ration is indicated for particular animals and for particular purposes, what should be aimed at is, that the desired Nutritive Ratios are maintained.

64. All animals require a minimum ration which is called the maintenance ration, to keep them in good condition, without loss of weight. Additional food of suitable kinds should be given, according to their needs. In the case of cows, this additional ration will be regulated by the quantity of milk yielded by each cow. A cow yielding 20 lbs of milk must have a richer supply of concentrates with a narrower N. R. than a cow yielding only 10 lbs. of milk. The maintenance ration should have a N. R. of 1: 12 to 1: 14. A milking animal will have a N. R. from 1 : 5 to 1 : 7, according to the yield of milk. A pregnant cow also requires additional food for obvious

reasons. The amount of casein, lactalbumin, butter fat, and lactose contained in the milk must come from the protein, fat and carbo-hydrates of the food. A complete matabolism of the food constituents takes place in the body of the animal. The food-carbo-hydrates are oxidised first; and they are said to protect the food-protein and the food-fat. The fat of the food is not absorbed as such, and stored as body-fat, but it undergoes considerable decomposition. The entire casein and lactalbumin of the milk must come from the food-protein; and nutrition experiments carried out in other countries show that more than 50 per cent of the body-fat or butter-fat is derived from the break up of the food-protein. The necessity for feeding milch cattle with foods, rich in protein, in other words, rations with a narrow N.R., is self-evident.

65. The care and feeding of calves of both cows and buffaloes deserve more careful attention from cattle breeders. Unlike other countries, where calves are weaned from birth and artificially fed by the hand, calves are allowed in India to suckle their mothers through the entire lactation period. It is worthwhile considering, whether calves may not be weaned from their natural food of milk, after they are two or three months old, and artificially fed with skim milk and gruel. Cruel sights can be seen, in cities like Madras, of calves not being sufficiently well fed from the udder of the cow, or receiving any artificial food as a substitute for its natural food. The entire milk, to the last drop, is drawn by the cowherd for sale, leaving only the exhausted udders for the calves to strike their heads against. It is to the advantage of the cowherd to feed the calves properly, as it will be an asset to him, not only for rearing healthy, future progeny, but also for their fetching a higher price.

66 The importance of oil-cakes has been indicated, and they should, therefore, be retained in the country, for use-, -edible cakes as protein-food and non edible cakes as nitrogenous manure. The export of oilseeds, as such, should be restricted, but after extraction, the oils alone should be sent out of the country.

A Necessity for Research on Animal Nutrition.

67. Some work has been done by Agricultural Chemists all over India; but what has been done is so little compared to

what has yet to be done. The following points require detailed investigation and research:—

The evolution of Feeding Standards and fixing up of Rations for different purposes have been done in other countries, and based on such researches, and on their application, better Livestock have been produced. Wolff's or Kellner's Feeding Standards may not be strictly applicable to India, with its different climatic and temperature conditions.

(i) What are the kinds of cattle foods and kinds of fodders and of grasses available in different parts of the country?

(ii) What are the compositions of these foods and fodders, and their nutritive values, so far as contents of protein, fat, carbo-hydrates, crude fibre, minerals and vitamins are concerned?

(iii) The necessity for careful experiments to determine Digestive Coefficients (true and apparent), Starch Equivalents, Calorific values and Nutritive Ratios of foods?

(iv) What are the feeding standards for calves, young animals, bulls, working cattle, heavy draught animals, milk-production, fattening animals, wool-production and egg-laying?

(v) What are the maintenance rations for different kinds of Livestock, and what are the rations for different purposes?

(vi) What are the nutritive ratios, feeding standards, and rations for cattle, buffaloes, sheep, goats and poultry?

(vii) What are the relative merits of different oil-cakes–groundnut–cake, linseed-cake, gingelly-cake, safflower-cake, cotton-seed-cake, and rape-seed-cake, and other concentrates, like cotton seed, crushed pulses and husks like dholl, black–gram, horse-gram and cluster beans, brans from wheat, rice and other cereals?

(viii) Is there not need to conduct experiments, as in other countries, on Metabolism as regards protein, fat, carbo-hydrates and minerals.

68. All these above points should not be considered as merely academic, but they are of practical application. We have lived long enough by empirical methods and by traditions. Just as we realise the need for better social amenities as a result of scientific knowledge and application of scientific results in other lines, we should also recognise the necessity for the introduction of scientific methods in the management of our Livestock, and in the production of milk, and in the manufacture of milk-products. This subject has received scanty attention so far. With the equipment available in most Agricultural Colleges, a student has no more than three or four chances, during his whole course, of handling a separator or a churn. Even this facility does not exist in most of the Veterinary Colleges.

69. In several countries of the world, special attention has been devoted to the improvement of Animal Husbandry. In some countries, Animal Husbandry receives even greater attention than plant Husbandry, and the income from animals is often greater than the income from agricultural crops. Animals receive special treatment, according as they are meant for production of milk or fattening for meat. So far as India is concerned, Animal Husbandry has until now held a subordinate place to agriculture proper. It is a side branch of the Agriculture Department. It may be safely stated that not more than one-tenth of the resources of the Agricultural Department, in the shape of staff, and funds, is used for the improvement of Livestock. A glance at the syllabuses and time tables of Agricultural Colleges will show what amount of theoretical instruction and practical training is given to the students of these colleges in Animal and Plant Husbandry respectively. So far as Veterinary Colleges are concerned, more attention has been paid to the treatment of animals in disease than to regular improvement of animals in health. Staff entrusted with the management of Livestock have been transferred from the Agricultural to the Veterinary Depart-

ment and vice versa, and little concentration of work on Animal Husbandry has been done by particular staff, specially trained in this line.

70. The solution is the appointment of Livestock Experts, specially trained in Animal Husbandry, and entrusted with the specific duty of improving Livestock in the country, as rapidly as possible. It will be an advantage to have the Director of Agriculture, the Director of Veterinary Services and the Livestock Expert, all working under one Development Minister. Livestock Experts have been recently appointed in several Provinces and Indian States, and they work under the orders of the Director of Agriculture in some cases, under the Director of Veterinary Services in others. All Governments are alive to the importance of the development of Animal Husbandry, and considerations of economy apart, it must be conceded that vigorous and sustained policy will be followed only when the Livestock experts have an independent responsibility and outlook, and have their own stock-men and superivisors, specially trained for the purpose to work under them.

71. Improvements in Animal Husbandry and Dairying have to be tackled in different ways, and there is work therein for Governments, for Cooperative Organizations, and for villagers themselves. Researches of all kinds, starting of large-scale industries, financing and subsidising of cooperative organisations and of villagers' efforts, and provision for technical skilled help are within the purview of the State. Cooperative organisation is apparently the best solution for most of our problems in Animal Husbandry and Dairying. Cooperative organisation is essential for starting societies in villages, for the better breeding of animals, for the collection of milk, for the manufacturing of milk into milk-products, for the transport of milk to, and distributing the same in, urban areas, and organizing Central Societies in towns for the purpose.

72. Efforts of Government institutions and of cooperative organisations will not bring about satisfactory results either in breeding or in milk production, unless and until the villagers

for whose benefit such efforts are made are persuaded to take up all practical lines of the suggested improvements.

73. Education of village folk.

The first essential for successful dairy farming, whether on cooperative lines or not, is the education of the villager to adopt clean habits of life, and incidentally to adopt hygienic methods in the handling of milk and milk–products. The routine work in a village is manifold. The cattle stalls and surroundings have to be kept clean, and farm-yard manure-dung, urine and litter,–has to be properly conserved. The cows and calves have to be washed, grazed and fed. The milking utensils, whether metallic vessels of brass, aluminium or tin, or mud pots and village churns, have to be cleaned with boiling water and daily exposed to the sun. Personal cleanliness is essential and clean well-washed clothes must be worn. The hands, up to the nail tips, must be scrupulously clean, and an all-round cleanliness must be maintained in the village homes. All these can be effected without additional expenditure. What is required is a change of slovenly habits and cleaner outlook of life. This can be done by education and propaganda, which must be undertaken by village guides, who have received some elementary instruction in a dairy, especially in the clean handling of milk and milk products. Such courses should be of short duration, open to educated middle class young men and women. As women folk in the villages deal with the feeding of animals and the handling of milk, the help of educated women as milk guides is indicated. Educated women, with a certain amount of leisure and a spirit of social service, will be most helpful in this propagandist work. Apart from using their knowledge of improved dairying in their own households, they could teach, practically, the uneducated women in the village how to handle milk and carry on dairy operations in a sanitary manner. Animal Husbandry and Dairying must be considered cottage industries in the sense that they give occupation to the villagers throughout the year, irrespective of agricultural seasons.

74. The sub-committee would like to make the following recommendations, to popularise Animal Husbandry and Dairying in the country, and to impart a rural bias to the children :—

(i) That elementary books on Animal Husbandry and Dairying, written in Indian languages, be introduced in rural schools.

(ii) that scholarships, sufficient to cover living expenses, be awarded to children of agricultural classes to undergo elementary training in recognised dairies, the course to extend about 3 months, and the instruction to be given in the mother-tongue of the students.

" Drink More Milk " Campaign.

75. The Government in Great Britain felt the need for starting a " Drink More Milk Campaign ", although the consumption of milk per head of population is very much greater than in India. The Daily Telegraph issued, four years ago, a Special Supplement, copiously illustrated, and containing messages from Ministers and Experts. The propaganda conveyed in this Special Supplement may be summed up in the following abstract.

" Milk is the food of foods. There is nothing superfluous or injurious in milk. It is the most healthful drink and food. It is difficult to think of any development, which will bring greater benefit to the nation as a whole than the increase in the consumption of milk. It contains the two best of all the proteins known to Chemists, Casein and Lactalbumin. It contains the most digestible of all the known fats. It contains six vitamins with their protective powers against deficiency diseases. It supplies all the necessary salts for growth. It contains all these food constituents in perfect balance. It has been evolved by nature for the development and growth of all the mammals, of which mankind is the masterpiece. No milk, no man. It was your first drink, whoever you are, & it will be your last drink ".

When propaganda of this kind is considered necessary in countries where cleanliness in the handling of milk is ensured and pasteurised milk is drunk directly from bottles, both by young and adults, and where already the average milk consumption is great, the necessity for doing such propaganda amongst

Indian population is self-evident. Let us also produce clean, healthy milk and start a "Drink more milk campaign". In view of buttermilk being a bye–product of the ghee industry in this tropical country, its use as a general drink should be encouraged. The same applies to separated milk also.

76. Smaller or bigger herds of cows and she-buffaloes are maintained by cattle owners within Municipal areas or at short distances from towns, for production and sale of milk in urban areas. The Polson Factory at Anand manufactures butter and casein on a large factory scale, while Private Dairies have installed pasteurising and refrigerating plants for the manufacture of butter. Cream separators and improved churns are also in use for the preparation of butter for the market in several cities and in villages.

Manufacture of By–products of Milk.

77. Assured of a daily supply of about 100,000 lbs of milk from the surrounding villages, the Polson Factory at Anand manufactures and sends out daily, 4,000 lbs. to 5,000 lbs of butter packed in tins and packets and several cwts. of casein, packed in gunny-bags. The establishment of such a large scale factory not only requires a large initial capital on buildings, plant and machinery and entails considerable recurring charges and working expenses, but is limited by the availability of very large quantities of milk within easy reach. There is room, however and plenty of scope, for starting factories on smaller scales than Polson's Factory, capable of producing from 300 lbs to 1,000 lbs of butter daily, with facilities for packing, apart from the processing of skim-milk into suitable by-products. These small scale factories may be undertaken by Government or private concerns of individual capitalists or Joint Stock Companies, or may be managed on cooperative basis by Cooperative Rural Creameries. Just as there are Factory Inspectors to supervise the working of other factories, there must be qualified Factory Inspectors to inspect private and cooperative Dairies, from time to time, to ensure that up-to date sanitary methods are adopted therein. Licences issued to these Dairies

should be liable to be withdrawn, when working is not satisfactory, and hygienic methods of handling milk and milk-products are not followed.

78. Messrs. Kirloskar Brothers, the well-known implement Manufacturers of Bombay, state that they will be able to manufacture Cream separators of different sizes and sundry dairy equipments in their works at Kirloskarwadi, at popular prices, if there is a demand for improved dairy appliances in the country; and that, as the parts required for their manufacture are simple and can be made in India, it will pay them to undertake mass production.

By-products of Milk.

79. The first and most important use of milk is its direct use for human cosumption in liquid form. The surplus milk will be utilised in the Rural Cooperative Creamery for preparation of butter, which may be used as such or converted into ghee. The preparation of butter and ghee under hygienic conditions is most important, as they are used so largely as foods, and are in great demand all over the country and fetch good prices. Good butter and unadulterated ghee are the first needs of the country and the first by-products of the Dairy Industry.

After the removal of the butter, the first by product of the Creamery is a skim-milk, sometimes called Separated Milk. This contains all the food constituents of milk, except butter-fat, namely the valuable proteins, casein and lactalbumin, lactose or milk sugar, the mineral salts and vitamins. Skim-milk can be used directly in liquid form as food; and this has been proved to have advantageous results in the experiments carried out by Dr. Ackroyd on the feeding of school children whereby substantial increases in weight and height have been noted in them. Skim-milk will also find its place in tea shops and in making ice creams. It has its use for feeding calves, when they are weaned, as suggested, when they are two or three months old. Skim-milk will, however, be more largely used for making curd and butter-milk. Curd and butter-milk are extensively used in every Indian house-hold, and the poorer classes of people, who often go without it, must be encouraged to make greater use of the cheap butter-milk in their diet; and it may be said that this will be partly ensured, as long as milk is handled in Rural Creameries.

80. When there is a surplus of skim-milk beyond local requirements for direct use as skim-milk or for conversion into curd, the surplus can be manufactured into suitable by-products. Which of these by-products can be taken up in the Rural Creamery will depend on the quantities of surplus skim-milk available every day. The preparation of casein, lactose, skim-milk–powder, condensed milk, preserved milk and khoa and milk-sweets will then receive due attention.

81. While the Sub-Committee is of opinion that there is scope for the preparation of the above by-products under the conditions mentioned in the previous paragraphs, the sub-committee feels, at the same time, that there is a necessity for a detailed investigation into the methods of preparing these products under the conditions prevailing in different parts of India, and specifying the localities where the manufacture of each of these by-products can be undertaken, and this investigation must be made by Government in their research stations. The initial attempts at manufacture may not produce by-products of as good quality as those now imported, but experience and continued investigation will lead to final success. The Cooperative Rural Creameries are probably the best agencies to undertake the manufacture of by-products of milk, but Government Institutions should also help by experimenting and advice. A small Committee of three to five members, which should include a qualified practical Dairyman, might be appointed, with advantage, to report on the subject of manufacture of all by-products of the Dairy Industry.

Manufacture of Ghee.

82. Unless the cost of production of milk is appreciably reduced, it will not be economical to the villagers to manufac-

ture ghee for sale to the public at a reasonable price. By increasing the yield of milk and improving its quality, the cost of production of milk and butter will naturally become less; and these in turn depend on improvements in breeding and feeding.

83. Just as cow's milk is preferred for drinking, cow's ghee is preferred to buffalo's ghee on account of its flavour and of its being more easily digestible; and it often fetches therefore, a higher price. As buffalo's milk has higher fat content, it is more economical to prepare ghee for large scale production and consumption from buffalo's butter. The long-established method of manufacturing butter from fermented whole milk or whole-milk curd will always continue, but improvement should be made by immediately preparing butter from fermented cream, as Creamery butter gives a better quality of ghee.

84. Ghee is an important article of food in the dietary of the Indian population, and the consumption of ghee depends on income level, and poor people often go without it. The present high cost of production of milk and of butter makes ghee costly, and adulteration on an extensive scale is practised all over the country, both in towns and in villages; and the punishments awarded by convicting Magistrates are not sufficient deterrents against this practice. Vegetable oils, hydrogenated oils and animal fats are the usual substances used for adulterating ghee. Each of these aqulterants is by itself a wholesome food, but is nowhere equal to ghee as a nutrient.

85. All edible vegetable oils are used in cooking all over the country, each kind of oil being more largely used in localities where it is produced, e. g so far as the Madras Presidency is concerned, cocoanut oil is freely used in Malabar, groundnut oil in South Arcot, gingelly oil in the Southern Tamil districts, and the Northern Telugu districts and safflower oil in the Ceded Districts. It is a matter of individual liking and taste that people get accustomed to some oils and do not appreciate the flavour of other oils.

86. Hydrogenated oils are edible vegetable oils which have been chemically treated, so that the liquid glyceryl esters of unsaturated fatty acids like oleic acid have been converted into solid glyceryl esters of saturated fatty acids. These hydrogenated oils have been labelled and sold as vegetable ghee. The term vegetable ghee is a misnomer, and legislation is required to prevent the naming of hydrogenated oils as vegetable ghee. Just as oleo-margarine, which was once called artificial butter is now labelled only as oleo. margarine,· and sold as such, the hydrogenated oils should be named as hydrogenated oils, or solid vegetable oils, but not as vegetable ghee or artificial ghee. To guard against deception, hydrogenated oils must be coloured with a harmless vegetable dye, other than yellow, which is the natural colour of butter, or the colour imparted to it in dairies with the annato-dye. To call these hydrogenated oils as ghee is most misleading and must be prevented by suitable legislation.

87. Animal fats have been used in cooking by those accustomed to non-vegetarian diet; and, in this sense, are; wholesome food. But the use of animal fat in adulterating ghee, which is consumed by vegetarians, is revolting to the religious sentiments of the vegetarian population, and such adulteration should, therefore, be absolutely prohibited.

88. The rancidity of butter is due to the careless handling of milk and butter, the storage of butter for several days, and insufficient heating or overheating. The Casein entangled in butter is largely responsible for producing rancidity, helped, on the one hand, by the water in the butter which hydrolyses the glyceryl esters, by which the free volatile fatty acids like butyric acid, which have a bad smell—are liberated, and, on the other, by atmospheric oxygen, which oxidises the fats, producing bad-smelling oxidised products. Cleanliness is the keynote for the manufacture of wholesome ghee, and considerable attention must be devoted to this aspect in the proposed Rural Co-operative Ghee Centres.

89, Food analysts have adopted laboratory methods of analysis to detect adulteration, and Dr. N. N. Godbole of the

Benares Hindu University has recently devised some new methods, suited to Indian conditions, to determine the degree of adulteration with various adulterants, which deserve experimenting in all laboratories.

90. The usual method of curdling milk is to add some sour milk to warm milk overnight. Sometimes the sour milk is spoilt, and consequently the curd and also the butter manufactured from it. It will be an advantage if standardised starters are made available at Rural Creamery Centres.

SHEEP.

91. It is estimated that not less than 50 million sheep are kept in India, but there is no systematic attempt at breeding. Flocks of sheep are maintained by shepherds of nomadic habits, who take their sheep from place to place, according to the availability of grass in new grazing areas, or according to the demands from cultivators for sheep-penning of their agriculural lands. Sheep industry is, therefore, in the hands of people, who are ignorant of the trend of modern developments. Neither the Government nor the public have given much attention to the problem of sheep-rearing. The foremost need is to have a systematic survey of the existing indigenous breeds and the sheep tracts. A closer study of environments and types of animals should be made by persons who are thoroughly conversant with sheep-breeding. Sheep are valued as much for mutton as for wool; and the education imparted to Agricultural and Veterinary graduates gives them little insight into sheep-breeding or wool-classing. The Government should, at once, undertake this work of training and sheep-husbandry at an Institute fully equipped for the study of sheep and wool,

92. There are some good breeds of sheep all over the country e.g. in Mysore and the Ceded Districts, and therefore, also immense possibilities of improvement in breeding by selection of indigenous sheep. The extreme variation seen in the wool-coat of the sheep is a fair indication of the chance it would offer in selection, and this would be followed by the individual study of different types and the mating of desirable animals. Good feeding is essential for individual selection, as animals exhibit maximum possibilities of development, only when they are adequately nourished. Feeding of sheep with concentrates is unknown in India.

93. The introduction of exotic breeds should also be undertaken, and the spread of these animals should be done with caution, and under the supervision of experienced organizers. The trials with exotic breeds should be made at Government Experimental Stations; and the movement of

these animals to suitable tracts should be undertaken only when the trials have been successful. There should be a guarantee of continuity of work in sheep breeding, as in every other country.

94. Each Province should have a Central Farm in its best sheep-breeding tract; and should have a few sub-stations to introduce improved breeds. Flock-owners in the vicinity of the sub-stations should be persuaded to organize themselves, with a view to maintain types of sheep, akin to the improved flocks kept at the sub stations, and a certain system of subsidising should be undertaken.

95. Considerable attention has to be paid to the production of wool and to its marketing. It is estimated that 86 million lbs. of wool are produced annually in India, but a considerable proportion of the fleece of wool is of small length. and often an admixture of wool, hair and dirt, so that the income to the shepherd from the sale of fleece is very small, e. g. one Kambli or coarse blanket is all that is given in exchange for the fleece of 50 sheep. The wool produced in India is largely consumed for village handicraft and manufacture of coarse blankets, although a small portion is exported. For manufacture of woollen cloths in the few mills established in India, wool is inported from other countries, chiefly Australia; and the imports in 1938 amounted to about 9 million lbs. of wool and 3 million lbs of yarn. There is always a great demand for woollen clothing in certain parts of India, and there is no reason why, with such a large sheep population in the country, India should import the raw material apart from finished woollen goods, and why India cannot become self sufficient with regard to its requirements in wool and woollen goods, and possibly become an exporting country as well. Improvement in sheep-breeding is the first requisite, and a study of the qualities of wool, the production of a better and cleaner quality of wool, and proper grading of wool, should receive simultaneous attention, along with marketing facilities.

96. The Agricultural Department of Bombay has a well-equipped sheep farm at Poona. Crossing of local sheep by

Marino rams, imported from South Africa, has been done in several parts of the country, with satisfactory results. The grading up of indigenous breeds by Marino rams has proved very successful in Mysore, where Sheep-Breeders' Associations have been organized, machine shearing has been introduced, grading of wool is done, and arrangements have been made for the better marketing of wool and kamblis, all with the initial help of the Agricultural Department of that State. The Government of Mysore also maintains sheep-breeding stations from which F-I and F-2 generations of cross-bred rams have been distributed to the villagers. It is also stated that the average weight cf 2 clippings of wool per year was about 10 lbs. for Marinos, 13 lbs. for Cross-breed, and less than 11 lbs. for country sheep.

97. The Sub-Committee recommends, (i) that sheep breeding stations should be established by the Governments of all Provinces and Indian States in selected localities, (ii) that help should be afforded to private shepherds by provision of suitable rams, by castration of indifferent male stock, and by improved methods of shearing of fleece, (iii) that facilities should be afforded in the grading and marketing of wool, by co-operative organizations, as far as possible; and (iv) that suitable grants be given to the shepherds at reasonable concession rates, if possible, by initial free grants, with a view to help them to produce better breeds of sheep and better quality of wool, along with a larger yield of fleece.

GOATS

98. Goats may be considered as the poor man's cheap milk animal. Goat's milk is highly valued for human consumption, but the yield of milk from goats is very small, as kids are allowed to roam about with the mothers and suckle the milk from the udder throughout the day. There is no recognized goat breeding in India. Stray goats are maintained in every village, the goats tresspassing all over the village and nibbling at every green stuff.

99. Improvement in goat breeding can be done by importing he-goats from recognized milk breeds. One of such breeds

is the Kamori breed of Sind, black or fawn in colour, possessed of a well-developed body, and characterised by long pendulous ears; the she-goats of this breed, kept at Poona, give an average of 4 lbs. of milk per day, which is really a substantial increase to the daily income of a villager. The American Arcot Mission, Katpadi, has already distributed a few he-goats of Jumnapuri and Soorti breeds. Government goat breeding stations are necessary, and the distribution of good breeds amongst breeders and villagers is also essential, followed by small financial assistance, from time to time. The Sub-Committee commends the proposal of the Imperial Council of Agricultural Research to import Angora goats as a nucleus for a future Mohair industry, following the return of an officer who had been deputed from India to study the breeding of the Angora goats and the Mohair industry. The Angora goat, originally indigenous to Asia Minor, and accustomed to live in dry climates, and to extreme variations of temparature, was introduced during the last century into suitable regions in South Africa. The produce of Mohair for a single season amounted to over 27 million lbs. of fleece, valued at over £ 200,000/-. The Angora has been successfully reared in U.S.A. There is a great demand in India for Mohair for textiles and other manufacturers, as it is a strong fibre, taking dyes easily.

POULTRY.

100. Poultry-keeping has received a fair amount of attention in all Provinces and Indian States. All Agricultural Colleges maintain a Poultry-yard, and most Governments and Indian States maintain Poultry-breeding Stations. The Government of India has recently published an elaborate report on the Marketing of Eggs, after an elaborate survey in the whole country.

The importance of poultry in India may be judged from the fact that, domestic consumption apart, it is estimated that 60 per cent of hen-eggs and 80 per cent duck-eggs are sold every year to the value of over 5 crores of rupees, the value of the birds themselves being estimated at 7½ crores of rupees.

101. Desi fowls are small birds with an average weight of about 3 lbs., kept in most houses in each village. and subsisting on worms and scraps of food from dung heaps and back-yards, They lay eggs of small size at irregular seasons, the average production per year being 50 to 60 eggs. The egg contents are highly-concentrated protein; and the hens should, therefore, be well-fed with nutritious food. The egg shell indicates the need for mineral salts, especially of calcium.

102. The introduction of superior breeds has, so far, produced satisfactory results in grading up the Desi breeds. Government Institutions have introduced cockerels of improved breeds with advantage; and have distributed selected eggs for hatching and selected chicks for rearing. Many Missionary Institu. tions and Y.M.C.A. centres have undertaken poultry work as a characteristic activity of rural reconstruction schemes. The work at Marthandam, in Travancore, is highly commended. not only for producing and distributing improved poultry, but also educating the villages all-round. The Government Poultry Farm maintained at Poona is a good example of how a poultry station can be started and managed, and attention may be drawn to the provision made here for the training of future poultry breeders. The Punjab Government has a central poultry station at Gurudaspur with half a dozen sub-stations in different parts of the Province. Indigenous fowls are selected and graded up, foreign breeds have been introduced, and both indigenous and foreign breeds are multiplied and distributed to the villagers.

103. All kinds of improved breeds of poultry, cockerels and hens, have been introduced into the country, and have got acclimatised in different places; and are worthy of further trial and adoption. According to reports received, the Leghorns seem to thrive everywhere. The eggs are usually more than double the size of eggs of Desi fowls, and a larger number of eggs are produced in a year. The importation of cockerel of superior breeds has been found beneficial and must be presisted in.

104. The trouble in poultry-keeping is that there is often a sudden outbreak of disease, causing the death of a large

proportion of fowls and chicks. The diseases have not been apparently well-studied; and better preventive measures must be evolved and demonstrated.

105. The per capita consumption of eggs per annum is 296 in Canada, 154 in Great Britain, and 8 in India. This is due, largely, to the bulk of the population having acquired vegetarian habits, who object to the eating of any food containing life. There are infertile eggs, however, having no life, which may be consumed. Such eggs can be examined by candling

106. While hatching of eggs by the hens sitting on them is the usual phenomenon, hatching in incubators under controlled temperature conditions has been successful in several places, and deserves to be further experimented on and demonstrated in all poultry stations. Egg-production may be said to be gradually increasing in the country, but grading and marketing arrangements for sale of eggs would bring in an increased income to the villager. Suitable poultry houses with wire netting are essential, and proper feeding must also be attended to. In this connection, we should like to draw attention to a small portable poultry house, designed at the Telankhery Farm, and exhibited at the Faizpur National Congress. The parts are easily detached and can be properly disinfected. The poultry house protects the birds and chicks from infectious diseases, rain, cold and sun, and can be made for a sum of Rs. 15/-.

107. We would like to invite the attention of the Planning Committee to the above mentioned Report on the marketing of eggs in India, published by the Government of India, for all the detailed suggestions made therein. For further improvements in poultry farming in India, the following recommendations may be made :—

i. Give subsidies and practical aids to villagers to keep improved stock and adopt improved methods.

ii. Widespread introduction of poultry and egg marketing centres on cooperative lines, so as to reduce the disparity between the price received by the producer and the price paid by the consumer.

iii. Encouraging trade in dried and liquid egg, for export, in those areas where there are sufficient poultry to keep the plant supplied with fresh eggs for processing.

iv. Introduce poultry pathology as subject of instruction in all veterinary colleges by the appointment of a whole-time poultry pathologist for teaching and research.

v. Poultry keeping is a cheap cottage industry, requiring the attention of the villagers during all seasons of the year, and, as such, it must be fostered by Government in all possible ways.

BEE-KEEPING

108. The use of honey, as an article of diet and as a vehicle for medicines, has been recognised in India from time immemorial. Such honey has been gathered from beehives inhabited by wild bees in the forests. Apiaries have been introduced in several countries, where domesticated bees have replaced the wild bees and bee-hives are kept near dwelling houses. Bee-keeping may be considered as a cottage industry, in localities where food is available in the shape of flowers for the bees to gather the honey from, in all months of the year. Bee-keeping has been *successfuly established in several parts of India*, and elaborate proposals are under consideration for the extension of bee-keeping in the Bombay Presidency. Bee-keeping and the distribution of hives has also become a regular feature in several Y. M. C. A. centres. The work of the Government Entomologists' section at Coimbatore deserves special mention. Careful investigation and study is carried on at the Insectory at Coimbatore into the habits of the wild and domesticated bees. Bee-hives have been introduced in several villages in most districts, demonstrations are given from time to time, and several agricultural demonstrators in the districts

have received some special training at Coimbatore. A Honey Week is celebrated once a year for demonstration and popularisation. The honey produced from the apiaries is pure and fetches a high price. The supply is not equal to the demand.

The cost of the hives is very small, but it is advisable to get the honey extracted from the hives with proper equipment whereby superior honey can be obtained without spoiling the texture of the hives. The Co-operative Centres can also arrange for the collection and sale of honey and bees' wax for the benefit of the villagers.

APPENDIX I.

(*Ref. para 29 of Report*)

The Pattagar of Palayamkottah in Coimbatore District is a rich land-holder owning large areas of dry land, which he has enclosed in convenient blocks, and in which a variety of grass called Kolakattai grass is systematically grown. For generations the family of the Pattagar has taken up cattle breeding as main profession. He breeds only the Kangayam breed, noted for its sustaining, draught qualities. Whether for ploughing, or for road transport, or for lifting water by motes, the Kangayam bullocks are well-known in South India. The cows are poor milkers, but they are well cared for. It is on the bulls that the Pattagar devotes greatest attention. The breeding bulls from Kangayam have not only been distributed in several districts of South India, but have occasionally been exported. He gives special attention to each class of animals, breeding bulls, working bullocks, cows and calves, and these animals are separately grazed in paddocks. Herds of animals are moved from one grazing block to another after a month. Manured as the blocks are with the entire droppings of animals, the first rain that falls on the land produces luxuriant grass; and, when the grass grows about 6 inches high, herds are let in again. Once in 5 or 6 years, the grazing areas are ploughed up and rotated with a cereal dry crop for a year or two, and afterwards replanted with tufts of Kolakattai grass. The annual rainfall of the locality is not more than 20 inches, but best use is made of the rain. His cattle population, including calves, was 2,000 at the time of my visit. The Royal Agricultural Commission makes special mention of the Kangayam breed of cattle as an outstanding example of careful cattle breeding.

APPENDIX II.

(I) The Telankhery Co-operative Dairy Society, Nagpur:

Thirty years ago a dozen *gaolies* joined together as a milk supply society in one of the suburbs of Nagpur; and in the same year Government started a Dairy Farm at Telankhery village on the outskirts of Nagpur. Neither was profitable; and the *gaolies* and Government combined at one centre, Telankhery. The gaolies brought their cows and she-buffaloes and the average yield of the combined herd was 800 lbs. of milk per day. Government provided facilities to the *gaolies* and the *gaolies*, in their turn, paid for everything, in the shape of rent for the buildings and cattle sheds, fees for grazing, commission on wholesale purchase and supply of concentrate and fodder, hire of feeding troughs and milk pails, and establishment charges for collection and distribution of milk. Cleaning of stalls, grazing, feeding and milking of animals was done by the *gaolies* themselves under the direct supervision of the Superintendent of the Government Farm, who was responsible to see that the cows were washed, and the milking vessels were kept clean, and that the entire milk was handed over to the Dairy. Steps were taken to minimise outbreak of diseases by preventing cattle from straying out of bounds. Five years later the *gaolies* of another suburb joined the Society. For some years the agency for selling was given to a private party, but was resumed by the Government in 1926.

The affairs of the Society were managed by a Panchayat under the guidance of the Deputy Director of Agriculture. In the year 1935, the average net profit of each of the 18 *gaolies* on the rolls amounted to Rs. 1,250/. In 1935 Government handed over complete management of the Farm to the Co-operative Society and the average profit during the last four years was Rs. 1,452/- per annnm. Rules have been framed by the Society for purchasing breeding bulls, advancing loans to individual members, stocking cattle food, concentrates and roughage, leasing grazing areas and collection and distribution of milk. The Society is now in full charge of (i) the Byramjee

Dairy with its equipments; (ii) a cattle food depot; (iii) the old grazing areas of 1,000 acres adjoining the Telankhery Tank on an annual lease of Rs. 2,000/; (iv) a new grazing area of the adjoining reserve on an annual lease of Rs. 7,000/-; (v) collection and storage of hay; and (vi) cattle sheds and quarters rented at Rs. 1,839/- per annum. Milk is purchased at 4½ pies per seer and sold at 3 annas, the profits eventually going up to the *gaolies*, as there is no middle man. The Society now runs a Primary School and affords medical aid; and there is a proposal to start affiliating Rural Co-operative Collecting Societies, with a suitable pasteurising plant to be called the Federation of Co-operative Dairy Societies of Nagpur.

The distinguishing characteristic of the Telankhery Co-operative Society of Nagpur is that the members are *gaolies* (who started with a small number of cows and she-buffalos and who own 25 to 50 animals each), that their cattle are housed, grazed, fed and milked at one centre under departmental supervision, ensuring a fair amount of cleanliness in the handling of milk before distribution, and that the members have acquired a spirit of self reliance in that they pay for every facility afforded by Government. The *gaolies* recognise that they are indebted to the officers of the Agricultural Department for doing all the spade work in the initial stages of working, and are now happy that they are able to stand on their own legs. The Co-operative Milk Unions are established in several cities and towns, where the care, management, housing and feeding of animals are left to the villagers themselves, without departmental supervision, the only condition imposed by the Milk Unions being that the cows must be brought to a common milking centre.

The Federation of Milk Unions in Calcutta started with one Village Society in 1917, rising to 10 Societies in 1919. There was gradual increase in the number of affiliated societies from year to year, with the result that there were 123 Primary Societies in 1935, with 7,500 members, a Share capital of Rs. 18,000/-, a Reserve Fund of Rs. 72,500/- and a Working Capital of Rs. 99, 300/-. The Union has a staff of Managers and Supervisors in the villages, who are paid a fixed pay plus a commission on the milk collected. The milk is transported to Calcutta in sterilized cans. The Calcutta Corporation gave a grant of Rs. 5,000/- for non-recurring charges, and a loan of Rs. 50,000/- which is utilized by the Union for making advances to members for the purchase of milch cattle, and for leasing lands for pasture and for growing fodder. 250 tube wells have been constructed in villages, 19 village schools have been started, medical aid is afforded to villagers, and periodical lantern lectures are arranged for them. The Collecting and Distributing Centre at Bow Bazaar, Calcutta, has facilities for laboratory analysis and for pasteurising, cooling, bottling, washing, refrigeration and air-locking; and Motor Vans carry the air-locked milk cans to markets, hospitals and private houses.

(ii) The Lucknow Co-operative Milk Supply Union

The Union was formed only 2 years ago with 8 registered Societies and 24 unregistered Societies. In addition to cows already owned by members, 124 milch cattle were supplied to them on *taccavi* loan. The Union handled 4,53,000 lbs. of milk, and made butter and 1000 lbs. of ghee last year. The net profit of last year was Rs. 1,035/-. The U. P. Government gave a grant of Rs. 30,000/- which is being utilised in the purchase of a motor van and in constructing wells and erecting sanitary milk sheds in the villages concerned. An I.D.D. has been appointed Manager, and the Union has provided employment to 130 men. The villagers have profited by having good milch cattle and getting a ready market for their milk at good prices. The consumers are supplied with more wholesome milk at comparatively cheap prices, and the milk problem of the city of Lucknow has been partly solved. Dr. K.N. Katju and Mr. N.C. Mehta, I.C.S. have testified to the usefulness and satisfactory working of the Milk Union and have suggested extension of the scheme to other cities and towns of U.P.

(iii) Milk Unions in the Madras Presidency

The Milk Unions started in Madras and several moffusil towns are recently established societies, the results of whose working are not available. There is a future for similar Milk Unions, organized on co-operative lines all over the country, so that unadulterated milk may be sent from the milk collecting centres. Great care is essential to see, however, that such milk sent from a Co-operative Centre, which is presumed to be genuine, does not get adulterated during transit and retail sale, before it reaches the consumer.

CO-OPERATION

(iv) Co-operation in Denmark

Although Denmark entered the co-operative field later than some other countries, the progress made by that country in co-operative activities is marvellous, and the methods of co-operative organisation adopted in Denmark are an object lesson to India. The growth of Co-operative Organizations in Denmark was mainly due to a few main factors, national education, capture of political power, passing away of landlordism and cooperation in every activity, and consequent raising of the standard of living in villages.

Co-operation

When the educated peasants became owners of small farms, the need for active cooperation amongst themselves was keenly felt by them, and co-operative societies were formed from time to time in every village and for a number of purposes, for production, transport and sale, and for manufacture of goods, and purchase of requirements. The village organisations were connected with the central co-operative Banks and Societies at the capital. Even railways are worked as a national concern with minimum fare and freight, and not with the object of earning an interest on capital invested. Co-operative Milk Unions and collecting centres, and butter and cheese factories were the first to engage the attention of these peasants. The total milk production in Denmark in 1934 was 11,800 million lbs., of which 80 per cent was utilised for butter making. Egg-producing societies, Bacon-manufacturing Factories, and Fertilizer-purchasing Societies, came next to be realised as equally important concerns. The Danish peasant is imbued with the spirit of co-operation practically in all transactions of life; and there are co-operative factories for clothing and tobacco, for roasting coffee and making chocolates, for Rural Electrification and Rural Transport, for Mutual Insurance, Unemployment Insurance, Old Age Pension and Cattle Insurance, and so on. It is worthy of note that co-operative activities have *emanated in every case from the desire of the villagers to cooperate,* and have not been superimposed on the villagers by the Officer of Government. This is the great lesson that Denmark teaches India. It may be that, in the present state of the economic condition of the people of India and the illiteracy and poverty of the villagers, considerable amount of Government help is needed in the initial stages; and this help should be in the nature of provision of facilities and guidance rather than of charitable doles. Speedy acquirement of literacy by the people, and the organisation of villages into Panchayats on an extensive scale, will naturally lead to the starting of cooperative organisation of villages in a spirit of self-reliance and of self respect. One must always remember that, after all, cooperation is business and not charity.

Detailed statistics are available to show the growth of the cooperative movement in Denmark in every line of activity and a concise statement finished in the following table :—

Cooperative Societies	No of Societies.	No of Members	Turnover in Millions of Kroners. (Appro. 1 Kroner. =1 Re
Production & Sale Societies.			
... Dairies	1,402	190,000	445
... Butter Export	11	641	134
... Bacon Factories	60	179,873	471
... Egg Export	700	45,000	21
... Cattle Export	15	12,227	5
... Seed Supply	1	3,400	4
Total ...	2,189	431,141	1,080
Agricultural Purchasing Societies.			
Purchase of food stuffs	1,387	89,473	90
Manure supply	1,450	60,000	16
Dairy Machinery etc.	1	1,680	7
Cement Factory etc.	1	1,097	3
Coal supply	2	625	7
Total ...	2,841	152,875	123
Consumer Societies.	1,824	335,900	403
Other co-operative Societies	6	749,946	11
Grand Total ...	6,860	1,669 862	1,615

(v) Dr. WRIGHT'S REPORT

In view of the fact that Dr. Wright's Report on the Improvement of Animal Husbandry and Dairying has been issued 3 years ago, and that action is being taken, and will soon be taken by all Governments, the Sub-committee has examined the Report in some detail and invites the attention of the National Planning Committee to his findings and recommendations. These will be embodied, for immediate reference as an abstract in the following paragraphs:—

The output of milk in India is estimated at 6,000 million gallons per annum and is second in the world, but, owing to the density of population, the average consumption per head is the lowest in the world, being about 7 ozs. Consumption of milk has been found to be dependent on income level, so that there is a vast population which does not get 2 ozs. of milk per day. To increase consumption of milk, there must be a greater production of milk in the country and the milk must also be produced at a lesser cost. Milk contains all necessary food requirements of human beings, and the need for greater consumption of milk-products in the country is, therefore, evident.

That the development of dairy industry should cater for the existing tastes and dietary habits of the population, that milk should be more largely consumed as liquid milk and that a good proportion of the surplus milk should be converted into ghee, will meet with general approval, but the statement of Dr Wright that the preparation of creamery butter and of milk-products, now imported, like condensed milk, preserved milk, and milk powder, is unnecessary for India, will not be so readily accepted. Khoa, about which Dr. Wright writes at considerable length, is at best a sweetmeat and an indigestible stuff, and has little or no keeping quality and is practically unknown in South India and several other parts of the country. The country may not be ready for large scale factories, but there is certainly considerable scope for starting small scale co-operative concerns for the handling and manufacture of milk and milk-products, in a hygienic manner. Cream separators and small pasturising plants must, sooner or later, come largely into use, in order that wholesome milk and milk products may be produced and distributed all over the country.

It is granted that, owing to insanitary conditions prevailing in the villages and the lack of knowledge of hygienic methods of handling milk, and owing to the fraudulant practices of adulteration, we do not always get healthy milk suitable for consumption. What is required therefore is the education of the villager and the affording of facilities to him to carry on his trade in an honest manner and with as much cleanliness as possible. Scientific investigations are also required in the production and handling of milk.

Good ghee is certainly valued in the Indian dietary. Dr. Wright quotes that 65% of the samples of ghee examined were adulterated. The relative merits of preparing ghee from *fermented cream* and *fermented whole milk* may require further investigation, but the respective advantages may be stated. With fermented cream, superior butter is obtained, which may be consumed as such or converted into ghee, and the by-products are butter-milk from the churning of the cream, which may be used for drinking, and skim milk, which may, according to conditions, be used for drinking, for conversion into curd and for manufacture of casein and milk powder. In the case of fermented whole milk, the butter produced has no keeping quality and has necessarily to be converted speedily into ghee. while the large quantity of sour butter-milk is available as food. Creamery butter has, therefore, apparently to be preferred even for the manufacture of ghee. Though this may not be practicable on a large scale immediately, the ultimate aim should be to prepare ghee from creamery butter.

Dr. Wright accepts that the processes of manufacture of Khoa, Dahi and other indigenous milk-products are primitive and crude; and that the nutritive values of these indigenous milk products are not known, but he would still advise the people of India that India should concern itself with their manufacture to the exclusion of recognized, refined milk products,—an advice which the Sub-committee is unable to accept.

CHEESE

Manufacture of cheese is certainly not possible all over the country, and it is a long way yet to prepare cheese similar to recognised brands, like the Cheshire cheese, but there are certainly some areas of suitable temperature conditions in India, where cheese of good quality can be manufactured provided proper technical guidance is available.

Dr. Wright contends that there is only a small market in India, for condensed milk, preserved milk and milk powder, that requisite quantities of milk of good quality are not available in the country for starting condensing and drying factories, and that it would be an uphill task for these locally produced articles to compete with standardised products of established reputation. Here again Dr. Wright seems to visualize that India should always be an importing country and should not attempt to start even small industries to meet the demand for the articles now imported, and that India should never venture to think of becoming an exporting country. Surely there is sufficient surplus milk of good quality in certain areas, for instance, in portions of Gujerat and Punjab, for manufacturing purposes. Should we not organise to stop these imports and produce our own brands of equal and better quality ? Why should Switzerland and Denmark dump their brands of condensed milk and butter into Indian ports ? It is not that the Indian does not appreciate the nutritive value of butter, but his income is too small to purchase butter at its present price. Why should good butter be the monopoly of the European population. Be it remembered that one of the important objects of National Planning is to displace imported articles by indigenous products, however small the money value of these imports may be. The value of the imported dairy products is stated to be only 75 lakhs, surely not an insignificant sum for India.

India has the largest number of cattle in the world and most of them are kept under uneconomic conditions. It is estimated that milk and milk products produced in the country are equivalent in value to Rs. 300 crores, equal to

India's total output of rice and equal to three or four time output of wheat. India has the largest export trade in hide: skins, valued at Rs. 40 crores, more than the value of In made sugar. The monetary value of Livestock is estimat 400 crores. In spite of the vastness of the cattle popul in India and of its large estimated value, India lags be other countries in the matter of sufficient milk for consi tion by the people of the country, let alone export of products to other countries.

Dr. Wright complains that very slow progress been made in the production and distribution of ped animals from Government stations. He stresses the nee the intensification of castration of useless bulls as a first towards the improvement of Livestock. He also advises expansion of the treatment of cattle by inoculation ag rinderpest. Cross-breeding with European breeds has ir long run proved disastrous. He suggests that Governm should adopt well-designed policies to meet local requiren and keep up continuity in the programme of breeding. (ful selection and breeding from indigenous strains of catt recommended, as also the maintenance of Herd Registers Milk Records. The present average yied of milk is calcu to be as low as 600 lbs. per cow per annum and points out this low yield is due to careless management and bad fee There is a marked deficiency in the amount of protein ir feeding of milch cattle. Coarse straws of cereals are valu and fodders of outstanding value which should receive a tion are the leguminous crops, berseem and lucerne. Inc in the supply of protein through concentrated food is re mended. He refers also to the framing of suitable ra for Indian Cattle and for a study of mineral and vit deficiencies in food, and of the diseases caused thereby. also points out that under-feeding of cows is responsibl slow rate of growth, late maturity and long dry period.

Dr. Wright recommends that a new Dairy Rese Institute should be started within easy distance of Delhi, w research work should be undertaken in Dairy Bacterio Dairy Chemistry, Dairy Technology and Dairy Husba

The present Dairy Institute at Bangalore is proposed to be closed, and the proposed Anand Creamery and Dairy Research Institute are not acceptable to him, although he suggests that the present building at Anand may be utilised as a sub-station. He also suggests the investigation of Dairy problems in all Agricultural Colleges, with the help of funds from the Imperial Council of Agricultural Research.

86. He considers that the present Indian Dairy Diploma is a suitable course and need not be extended to three years as proposed, and suggests that the training for the I. D. D., now given at Bangalore, may be given at the Agricultural Colleges with provisions for additional equipments and an additional lecturer specially selected for the purpose. He suggests that there should be practical training in the methods of imparting instructions to the villagers and doing propaganda, and is of opinion that the trained men will be useful for work in the proposed village centres organized on co-operative system. Elementary dairying and handling of milk and dairy herds should, in his opinion, be also taught in the Veterinary Colleges. Short popular elementary courses in Dairying are also recommended.

87. Provincial Governments should have an Advisory Board for Dairy Industry; and a Development Officer should also be appointed with a view to ensure dairy developments and to encourage adoption of improved methods. There should be a co-ordination between Central and Provincial Governments and the Director of the proposed Central Research Institute should also be the Dairy Expert to the Imperial Council of Agricultural Research.

88. Dr. Wright recommends the appointment of an Animal Genetic Institute and suggests that the Imperial Nutrition Research Intitute at Izatnagar should undertake the duty of producing a number of geneticists. The proposed Central Research Institute should collate nutrition work done so far at Lyallpur, Dacca and Coimbatore; and also undertake analysis of fodders and feeding stuffs. He also recommends that the Imperial Council of Agricultural Research should award scholarships, from time to time, for post-graduate study abroad.

89. He suggests the appointment of a Fodder Specialist to work with the Livestock Expert. For efficiencey and economy, he would like that livestock improvements and veterinary work should be unified in one Department of Animal Husbandry. He asks for more funds for Animal Husbandry for all-round improvement.

90. Military dairy farms, district and demonstration farms, gaushalas and panjrapoles, should, in his opinion, be all utilised for developing milk potentialities of indigenous cattle.

91. He also recommends the constitution of a Board of Rural-Development in each province, with a view to maintain co-operation between all departments concerned. This Board should include Directors of Agriculture, Veterinary Services and Public Health, and Officers of the Forestry, Revenue and Co-operative Departments, and also Technical Experts. The Chairman should be a non-technical officer of the rank of a Commissioner. Apart from being a Co-ordinating Advisory Body, the Board should make direct representations to the Minister for Agriculture.

92. The Sub-Committee on Animal Husbandry and Dairying begs to express its opinion that it agrees with Dr. Wright in most of his findings and recommendations to take speedy action on his Report. The Sub-Committee regrets its inability, however, to accept his conclusion, that India should be satisfied with crudely manufactured milk-products, and that there is no need in India for refined milk products now imported into the country. The consensus of opinion received by the Sub-Committee in reply to its circular is that there is need for the starting of large scale Dairy Industries by Governments, and of small scale Industries by Co-operative Agencies. The Sub-Committee would also like to point out that considerable amount of research and propaganda work in Animal Husbandry and Dairying of appreciable value has been done by Agricultural, Veterinary and Livestock Departments in the Provinces, as revealed by the published reports and bulletins received from them, although, adequate recognition of such work has not been mentioned by Dr. Wright in his Report. There is also bound to be a considerable difference of opinion whether there is need for a costly Central Research Institute near Delhi; and whether the older Dairy Institute at Bangalore and the already sanctioned Creamery and Research Institute at Anand should be scrapped.

APPENDIX. IV

Report of the Expert Cattle Committee of Bombay

93. There is another recent publication, made available to the Sub-Committee, namely the Report of the Expert Cattle Committee of Bombay, to which the attention of the National Planning Committee may be invited. The importance of this Report lies in the fact: (i) that the Expert Committee was set up by the Bombay Congress Ministry a few months before their resignation, with terms of reference similar to those issued by the National Planning Committee; (ii) that the findings of the Committee, though particularly related to the Bombay Presidency, are generally applicable to all Provinces and Indian States (iii) and that it is desirable that other Provinces and States should appoint similar committees, to make recommendation, suitable to local conditions with definite proposals brought up to date. The Sub-Committee is, therefore giving below a concise abstract of this Report for ready reference.

94. An Expert Cattle Committee was appointed by the Government of Bombay in April 1939, with the following terms of reference, among others :—

(i) to give final shape to schemes under consideration for the improvement, as far as possible, on co-operative lines, of the breeding of milch cattle in all parts of the province.

(ii) to submit complete and detailed proposals for starting such breeding work in at least 5 centres in the province ,which should include estimates of expenditure, recurring and non-recurring, including capital investment;

(iii) to draft suitable schemes for the supply of milk and milk products to urban areas;

(iv) to advise the Government regarding restriction of slaughter and the problem of salvage of milch animals;

(v) and to report on the possibility of starting skim-milk powder industry.

The Committee consisted of the Director of Agriculture. the Livestock Expert, the Deputy Director of Rural Development, an Assistant Registrar of Co-operative Societies, and Mr. D. V. Pandya; and met at intrevals for ten days. The Imperial Dairy Expert, Bangalore, attended the meetings of the Committee by invitation.

The Livestock census taken in 1934-35 showed that there were 10 million cattle in the Province, of which 3 million were working bullocks, 1,800,000 were cows, and 11,00,000 were milch buffaloes. 80 percent of the milk produced in the Province was buffalo's milk, the cow taking a subsidiary place as a milk producer. The cattle of the Province are not an economical proposition, 60 percent of them being a drain on the country, maintained at a loss to the breeder and the State. The reasons for this are as follows:—

(i) The popularity of the buffalo as a milk-producer has resulted in the neglect of the cow, which, as a result of careless and indifferent breeding, is late in maturity and irregular in calving. In certain rural areas, the female buffalo is better looked after and the female buffalo-calf as well, and the cow-calf is neglected from birth.

(ii) Uncontrolled system of village grazing, whereby uneconomic cattle are maintained, mongrel bulls serving village cows causing deterioration both of draught cattle and milch cows.

(iii) It is a striking fact that, in areas where grazing is not largely available, best cattle are found, due to their being adequately stall-fed.

(iv) The establishment of city milk stables, and the replacement of the bullock by motor power in road-transport, have also contributed to the deterioration of the cattle.

3 distinct classes of breeds are bred in the Province :— (a) Commercial Dairy Animals (b) Dual Purpose Animals and (c) Draught Animals.

(a) **Commercial Dairy Animals** :—

(i) These include :—

The Kankrej Breed, large in size, yielding 2,000 lbs. of milk per lactation on the average, going to 6,000 lbs of milk, containing about 5 percent of butter fat ; useful for fast draught work.

(ii) **Gir breed**, found all over the Province, having capacity of transmitting its milking quality to its progeny when mated to country stock, yielding an average of 2,500 lbs. of milk per lactation, reaching up to 6,000 lbs. of milk with about 5 per cent of fat, a more docile animal than the Kankrej, a slower draught animal, suitable, however, for heavy draught.

(iii) and the **Red Sindhi**, a small sized cow, yielding an average of 2,5000 lbs. of milk, going up to 5,000 lbs. with an average of 4.5 per cent of fat, deficient in draught.

(b) **Dual Purpose Animals** :—Draught animals, with potentialities as milk-producers. These are :—

(i) **The Nemori breed**, hardy, draught animal, yielding about 1,600 lbs. of milk per lactation on the average ;

(ii) **The Dangi breed**, largely restricted to hilly tracts, working in rice fields, and in tracts of heavy rainfall, yielding about 1.500 lbs. of milk ; and

(iii) **The Krishna Valley breed**, apparently a cross between the Gir and Nellore breeds, yielding an average of 1,600 lbs. of milk, which may go upto 3,000 lbs.; a heavy sized, sluggish animal, now going out of favour.

(c) **Essentially Draught Breeds:**

Under this heading may be mentioned :—

(i) **The Khillar breed,** bred under rigorous conditions, and said to be hardier than the Amritmahal.

(ii) **The Amritmahal breed** a quick, draught animal, bred under careful attention and feeding and found on the borders adjoining Mysore, and

(iii) **The Malvi breed,** imported from Central India.

Of the buffalo breeds which may be classed as *Commercial Dairy Animals* are the Soorti, the Murrah and the Jaffarabadi buffaloes :—

(i) Soorti or Gujrati—highly domesticated and stall-fed, with an average yield of 3,500 lbs. of milk per lactation, going upto 5,800 lbs; the males are poor workers.

(ii) The Murrah and the Jaffarabadi buffaloes—good milk breeds, transported into Gujrat. The contention for the inroad of the Murrah and Jaffarabadi buffaloes is that these outside breeds are in milk, when the Soorti buffaloes go dry.

Of the Commercial Dairy buffaloes which are also good draught animals, may be mentioned the Pandharpuri breed, which gives an average yield of 3,000 lbs. of milk, sometimes going up to 6,700 lbs.

The most important portion of the Expert Cattle Committee's Report is the Chapter referring to the *Co-operative Organization for cattle Breeding and Milk-Production,* which is dealt with under three heads :—(a) Cattle improvement and milk-Production in villages, (b) Milk-production and processing, and (c) Transport of milk-products to consuming areas and distribution. The following are the recommendations :

(1) Organise groups of co-operative cattle breeding and milk production societies in villages, each group to consist of about 5 villages capable of supplying

3,000 to 6,000 lbs. of milk daily, lying within a radius of 10 miles from the Central Collecting Centre; the distance from the Centre may later on be increased, with better facilities for transport;

(ii) These Village Societies should undertake: (a) the breeding of improved milch cattle, (b) the production of milk on a co-operative basis, and (c) the cultivation of fodders, the preparation of hay and silage, and the management of grazing areas;

(iii) Each group of 5 villages to be supplied by Government with 100 milch cows—the Society's Herd—and 5 breeding bulls, so that each village will have 20 cows and one breeding bull, the price of the cows payable, without interest, in instalments spread over 3 to 5 years.

(iv) Members should agree not to sell female progeny without sanction. The male progeny of the cows of the Society's Herd will be the property of the cultivators, but the Society has the right to purchase them before they are three years old. The breeding bull of the Society's Herd will be the property of the Society, and will be entrusted to one of the members for maintenance, with a monthly allowance of 7 to 12 rupees. The Society must maintain service records, and arrange for the correct marking of the animals and their progeny. The Societys' Herd will consist of cows only.

(v) For production of milk on a co-operative basis, the Society Herd plus the number of milk animals including buffaloes, belonging to members, will form the Milk-Herd of the Village Society.

(vi) Wherever a Co-operative Milk Production Society is established, a central milking site will be arranged for, to which the Milk-Herd will be brought by owners twice a day for milking. The entire milk of each animal must be handed over to the Milking Centre, less domestic requirements. The Milk-Herd of the Society will be despatched twice daily to the Central Collecting Centre. Payment for milk, less Society's commission for working expenses, will be settled once a week. Advances may be made by the Society to members against proceeds of milk.

(vii) The Cattle breeding and Milk Production Societies should arrange for co-operative purchase of concentrated feeding stuffs, for sale to members at their option at minimum prices.

Milk Collection and Processing:—The future development of milk-production in villages, especially cow's milk, is primarily dependent upon adequate organization for the collection of a sufficient quantity of milk at a Central Collecting, Processing and Distributing Station, prior to marketing to consumers. To begin with, these centres may be only Collecting and Distributing Stations of fresh milk, but the ultimate development must be in the direction of Rural Creameries, where milk may be processed, i.e. cooled or pasteurised, before distribution and where surplus milk can be manufactured into suitable milk-products.

These Village Co-operative Societies should be affiliated to a Central Co-operative Agency which should undertake collection and distribution in urban areas. Co-operative Rural Creameries should be organised throughout the district, along with groups of Village Societies. The estimated cost of a Co-operative Rural Creamery to deal daily with 6,000 to 12,000 lbs. of milk is Rs, 60 000/- non-recurring, and Rs. 22,500/- annual recurring expenditure. Government should undertake the financing of these Creameries by loans free of interest.

The organisation of Central Co-operative Rural Creameries, supported by a number of Primary Village Co-operative Societies is the only practical method, whereby village milk production can be linked up with urban milk consumption, with profit to producers and consumers alike. The same organisation is the best method of encouraging breeding of milch cattle by cultivators under village conditions. It is desirable to make these Rural Creameries, the main agencies for extension of milch cattle, and Government should give a recoverable grant of Rs. 10,000/-per annum, to the approved members of the Constituent Village Societies for the purchase of additional cows. Each Co-operative Creamery should arrange for an Annual Cattle Show to facilitate purchase and sale of cows. Each Creamery should also organise periodic Dairy Days for demonstration and propaganda.

It is desirable that Government should, in the first instance, establish Rural Creameries in select areas, run them for 2 or 3 years, and then hand over to the Co-operative Creameries concerned. Government should also encourage Creameries by technical advice and by education, demonstration and propaganda,

Distribution of Milk and Milk-Products:—The Central Collecting Organisation, i. e. the Co-operative Rural Creamery should instal pasteurising and cooling plant on its own premises, and transport milk to Urban Consuming Centres in insulated Railway wagons, for which the co-operation of the Railways must be obtained. The actual distribution, retail and wholesale, in urban areas is best entrusted to recognised agents. The additional cost of processing milk by pasteurisation is estimated at 1.5 pies per pound of milk. It is better to pasteurise the milk in the Rural Creameries before despatch to urban areas. Government should ensure that all Government institutions, hospitals, jails, schools, etc., should buy their milk from the Co-operative Agency. Government should also help in the following ways:—

(i) a Superviser for each group of Village Societies for a period of at least 3 years.

(ii) a free grant for the establishment of milking sites in villages.

(iii) an annual grant of Rs. 3,000/- as a loan, free of interest, to each Co-operative Creamery, for being used by Constituent Village Soceties in the equipment for sanitary milk production.

(iv) a Dairy Development Officer, in the grade of an Assistant Registrar of Co-operative Societies, to supervise the work of all the societies in the Province with technical advice from the Livestock Expert to Gevernment.

So far as the Bombay Presidency is concerned, ten suitable tracts have been suggested for the starting of these societies, the first five of them being (i) Anand for Kankrej breed, (ii) Thana District for the Gir Breed, (iii) Belgaum for the Gir breed, (iv) Jalgaon for the Gir Breed, and later on the Nemer breed and (v) Pandharpur for the Gir breed. The breeds may be changed, however, after some experience, by the addition of suitable dual purpose breeds.

Before starting these Co-operative Rural Creameries and Village Societies, Government should appoint an officer on special duty to make an intensive survey of the villages round the proposed centres for determining the present available milk supply and the future potentialities of extension.

For the successful work of these Co-operative Societies a few conditions are necessary:—

(i) the price of milk in villages should be about 25 per cent less than the price of milk now prevailing in urban areas;

(ii) each village society should be able to supply not less than 3,000 lbs. of milk daily, to enable the Central Rural Creamery to work economically. The scheme should be so worked that the production of milk from each village group will rise to 6,000 lbs. of milk within 3 years;

(iii) the village selected should have grazing lands worked under controlled conditions. They must also have facilities for growing green fodder throughout the year, under irrigation, and for stocking sufficient hay or ensilage to last for 6 months every year.

(iv) The Villages selected for the Co-operative Societies should not be more than two hours' journey from the Co-operative Rural Creamery, and the communications must be such as will permit the transport of milk in all seasons, for instance, monsoon, rains, floods, intervening rivers, etc.

Recommendations on Cattle Breeding and Government Policy :—Government must encourage the better breeding and care of the milch cow, the buffalo and the various breeds of draught cattle, indigenous to the Province. Each of these main types of cattle has its place in the village economy, and their relative importance depends on the type of agriculture practised and on environment.

The Government should devote all its energy and resources to the improvement of the milking capacity of cows, by the introduction of good milch cows like the Gir and Kankrej, and by providing facilities for the crossing of village cattle by selected bulls, She buffaloes give a good amount of milk and the he-buffaloes turn out into good draught animals for agricultural work. The buffaloes, should, therefore, be considered as dual purpose animals and receive encouragement from Government.

The milch cow has been neglected so far. The she-buffalo due to her larger milk yield and higher fat-content, has been better looked after, and the cow cannot possibly altogether replace the buffalo as the main milk-producer of the country for many many years. Cow's milk is known to be preferable to buffalo milk for direct human consumption.

The buffalo is the butter-fat producer of the Province· It is best to encourage the villager to use the cream separator for separation of cream and skim milk. Co-operative Ghee Manufacturing Societies should be encouraged in localities not suitable for the organisation of village co-operative societies, far removed from urban milk consuming centres. Government should advance an initiative loan of Rs. 3,000/- to the Rural Development Department for loans free of interest, to Co-operative Ghee Societies for purchase and installation of equipment, and for better manufacture of ghee on a co-operative basis.

Draught cattle breeds require less attention than cattle for milk-production.

The Premium Bull Scheme, for which an annual grant of Rs. 10,000/- is made, has worked satisfactorily and needs expansion. An additional grant of Rs. 5,000/- may be made by Government, particularly for breeding dual-purpose animals. The Premium for maintenance may be increased from Rs. 7/- to Rs. 10/- per mensem. Government must undertake scientific work in Government Farms for increasing milk-production and for production of male and female stock of milking strains for distribution. All attempts by Government to develop Dairy Industry in rural areas for urban milk supply will be handicapped, if action is not taken simultaneously to control the production of milk within the city. Stricter enforcement of existing legislation and municipal regulations is essential to eliminate unfair competition based on adulteration. The Laws and Regulations have to be revised, the number of qualified Milk-Inspectors have to be increased, and graded license-fees have to be levied on milk-producers and milk-shops within the city. Penalties for milk adulteration should be adequate. The present system of licensed milk-hawkers in the city should be abolished.

Apart from Government Cattle Breeding Stations and the Agricultural College Dairies, there are a number of private non-official Institutions carrying on cattle breeding, some of whom get assistance from Government by an annual subsidy in money or by concession in grazing areas. Some of these private Institutions started with the object of salvage of dry and old animals against slaughter, but have gradually been converted into regular breeding centres to produce better breeds of cattle. The people of Gujerat in particular are actuated by religious sentiment and have a veneration for the cow, like the Hindus all over India, and the establishment of pinjrapoles or Gaurakshak Shalas is a common feature in the

Bombay Presidency. Several communities other than Hindus have also helped in this cause. Well-bred pedigree bulls from these cattle farms should be purchased by Government at prices ranging from Rs. 250/- to Rs. 300/- and distribute to the villagers.

Skim-milk Powder Industry:—6,431 of skim-milk powder valued at Rs. 1, 55,050/- was imported in Bombay in 1938-39 the average cost price being 3½ as. per lb. and the retail selling price ranging fron 4½ to 6 annas. Eight lbs. of water added to one lb. of powder make 9 lbs. of skim milk. It is used in ice-cream shops and teashops, and more extensively for the adulteration of milk. As a result of this import, the whole sale price of milk in Bombay city, which ranged between Rs. 7-8-0 to 9-0-0 per maund, has now dropped to Rs. 5-8-0 per maund. The unrestricted import of milk powder has had a deleterious effect on the fresh-milk trade of Bombay, and has also affected adversely small Dairy and butter-manufacturing concerns.

There is ample scope for the development of Skim-milk Powder Manufacturing Industry in parts of Gujerat, to start with, and it deserves Government help. It will help in the profitable working of Rural Creameries, Government should at once reimpose the import duty at least 20 per cent. It may be stated that the Bombay Milk-Merchants' Association recommends an import duty of 25 per cent. A suitable officer should be trained abroad in up-to-date methods of manufacturing skim-milk powder, and should be available for co operative organisations and private concerns. Government should subsidise the industry for at least 5 years, by loans, free of inter est, or by guaranteeing any loss during this period in the case of co operative organisations.

The question whether Roller or Spray process of manufacture should be adopted, must be considered after some experience of the working of both systems has been obtained. The slightest acidity in the milk will render milk useless for the purpose. The establishment of the Dairy and of the Factory for skim-milk powder in Gujerat will necessitate the collection of pure fresh milk at least twice daily, and Co-operative Rural Creameries are the best centres for small scale manufacture of skim-milk powder.

APPENDIX. V

Dr. Haddow's Presidential Address,

In his Presidential Address delivered at the recent Indian Science Congress at Madras on *Animal Husbandry*, Dr. Haddow reviews the present position of Livestock in India. His remarks are summarised below for ready reference :—

From ancient times Animal Husbandry was affected in India by 2 main factors—*Disease* and *Famine.*

Disease :

The trend was to encourage unrestricted multiplication so that some animals at least will survive during disease and famine; and this led to the destruction of breed characters and determination of type. Animal diseases may be classified as Virun, Bacterial and Protozoan, and researches in diagnosis and treatment are incomplete, e. g. rinderpest, which is the biggest scourge of the husbandmen. Efficiency and reliability of the simultaneous serum innoculation method has long been recognised, but it costs Rs. 1/- per animal which is too costly for the villager. Dr. Edward solved this by finding the cheaper goat virus method, but still it is not a full success, because epizootiology of diseases has not been fully studied owing to want of trained staff. Similarly researches into other diseases have been spasmodic and incomplete. Accurate diagnosis must precede protection in virus disease. As regards Bacterial diseases, Anthrax affects all animals and is communicable to man. Therefore, there is restriction in international trade in the handling of hides and wool, lest they contain the Anthrax Bacillus.

Famine:—

Scarcity of water and of rainfall leads to scarcity of vegetation. Either animals should be transported to new areas, or fodder must be brought to animals by transport on rails. Overgrazing has led to soil erosion.

We must realise that cattle cannot exist merely on waste materials of intensive farming. This is exemplified by the fact that cattle in areas of rich soil, for instance, rice tracts, are markedly deteriorated, while better types of cattle are found in arid tracts, for the reason that rice straw is not a complete food. Mineral deficiencies of soil are reflected in the fodder grown. Nutrition of cattle is as important as nutrition of man. Protein is most urgently needed in cattle food. Man, however, uses all the valuable protein of crops; but if cattle are well fed, man will get the protein in return in the form of milk or meat.

Well balanced supplies of food will result in increased production, but will also help the animals to resist disease and infection.

Increased knowledge of genetics is essential to decide on milk or draught animals.

No appreciable work has been done on sheep and goats.

Education of the husbandman is most important. He will then guard himself against famine and disease, and will then guard his Livestock from famine and disease as well.

APPENDIX VI

Statement showing the Names of Persons from whom replies were received to Circular issued by the Sub-Committee

Serial No.	From whom replies were received	Nature of Reply
1	Agricultural Officer N.W.F.P.	General Remarks.
2	Commissioner of Agriculture, Baroda.	Do.
3	Director of Agriculture, Assam	....
4	Director of Agriculture, Bombay.	General Remarks.
5	Director of Agriculture, Cochin.	Do.
6	Director of Agriculture, Hyderabad.	Cattle, Poultry.
7	Director of Agriculture, Madras	Pamphlets.
8	Director of Agriculture, Mysore	General remarks, Bulletins & Reports.
9	Director of Veterinary Services, Hyderabad.	General Remarks, Bulletins.
10	Govt. Entomologist, Coimbatore,	Bulletins on Bee-keeping.
11	Livestock Expert, Bengal.	General Remarks, Bulletins.
12	Livestock Expert, Poona.	General Remarks, Reports & Bulletins.
13	Livestock Expert, Poona.	Notes on sheep.
14	Livestock Expert, Poona.	Notes on Bee-keeping.
15	Principal, Agricultural College Poona.	General Remarks.
16	Poultry Expert, Punjab.	Notes on Poultry Bulletins.
17	Senior Marketing Officer, Lahore.	General Remarks, Reports & Bulletins.
18	Secretary, Imperial Council of Agricultural Research.	Notes on Planning, Bulletins.

APPENDIX VII

Communications received other than replies to Circular

Serial No.	From whom communications were received.	Nature of communication
	Dr. Haddow, Imperial Veterinary Research Institute, Mukteswar.	Presidential address on Animal Husbandry delivered at the Medical & Veterinary Section of the Indian Science Congress held in Jan. 1940 at Madras.
2	Mr. C. B Samuel, Bhopal.	Note on salvage of useful cattle from slaughter.
3	Mr. B. C. Doss, Delhi.	Note on the development of Dairy Industry in India.
4	Mr. B. C. Doss, Delhi.	Note on Control of Breeding.
5	Miss Karnad, National Planning Committee Office.	Abstract of literature.
6	Manager, Polson's Factory.	Notes based on personal discussions & letter on small scale Dairy Factories.
7	Messrs. Kirloskar Bros, Implement Manufacturers.	Notes on possibility of manufacturing cream separators in India.
8	Pattagar of Palyakottah.	Notes based on personal discussions.
9	Superintendent, Govt. Dairy-Farm, Telankhery, Nagpur	Notes on working of the Govt. Dairy Farm.
10	Superintendent, Govt. Dairy-Farm, Telankhery, Nagpur.	Note on working of the Government Poultry Farm.
11	Secretary, Telankhery Co-operative Dairy Society.	Note on Historical Development of the Telankhery Dairy Society.

APPENDIX VII (*Continued*)

Serial No.	From whom Communications were received	Nature of communication
12	Secretary, Telankhery Co-operative Dairy Society	By-laws of the Society.
13	Co-operative Milk Union, Calcutta.	By-laws of the Union
14	Registrar of Co-operative Societies, U. P.	Note on milk supply o Lucknow & Pamphlets.
15	Superintendent, Northcote Cattle Farm, Chharodi.	Note based on persona discussion.
16	Superintendent. Gaurakshak Mandali, Kandivli.	Notes based on personal discussion & Golden Jubilee publication.
17	Secretary, Co-operative Milk Union ,Coimbatore.	Last Annual Report (in Tamil) By-laws of th Co. op. Milk Union
18	Secretary, Milk Union, Madras	Notes based on persona discussion.

APPENDIX VIII

Statement showing publications received and consulted

Serial No.	Name of Publication	From whom received.
1	Denmark in the Co-operative Way and 9 other books.	On loan from the College Library; from the Principal, of the Agricultural College, Coimbatore,
2	Work of the Livestock Section in Madras by R. W. Littlewood.	On Loan from the Director of Agriculture, Madras.
3	Annual Report of the Bombay Agricultural Department.	On loan from the Superintendent, Northcote Cattle Farm, Chharodi.
4	Report of Chintaladevi Cattle Farm.	On loan from the Superintendent of the Government Cattle Farm, Guntur
5	Report of Guntur Cattle Farm.	Do.
6	Calcutta Milk Supplies.	On loan from the Director, Veterinary Department. Hyderabad.
7	Livestock Improvements in India by Sir A. Oliver.	Imperial Council of Agricultural Research.
8	Pedigree Registration & Milk recording by K P.R. Kartha	
9	Systematic Improvement of Livestock in India by Sir Oliver.	
10	Pamphlets on poultry, goats & sheep by Sir A. Oliver.	
11	Annual Report for 1938.	Imperial Dairy Expert, Bangalore.
12	Note on slavage of Dry Animals.	Do.

APPENDIX VIII (*Continued*)

Serial No.	Name of Publication	From whom received
13	Bulletin on Poultry Breeding (I. C. A. R. Publication)	Govt. Poultry Expert, Punjab, Gurdaspur,
14	Bulletin on Caponisation of cockrels (I. C. A. R Publication)	Govt. Poultry Expert, Punjab, Gurdaspur.
15	Bulletin on Aroma in Dahi. (I. C. A. R. reprint).	Miss Karnad.
16	Golden Jubilee of Cattle Farm, Kandivli.	Bombay Gaurakshak Mandali.
17	Bulletin on Cattle breeding in Bombay by E. J. Bruen.	Livestock Expert to Government of Bombay, Poona.
18	Report of Expert Cattle Committee of Bombay.	
19	Bombay Act. XXII of 1933 Act to provide for Improvement of Livestock.	
20	Progress of Dairy Husbandry in India during last 25 years.	Mr. Zal. R. Kothavalla Imperial Dairy Expert, Bangalore.
21	Cost of Milk Production at Lyallpur. Publiction No 25 by D.P. Johnson & S. Kartar Singh.	Senior Marketing Officer to Govt. of Punjab, Lahore.
22	Cost of Milk Production at Lyallpur publication No. 55 by Kartar Singh & Lalchand Sikka.	
23	Cattle in Mysore.	Director of Agriculture, Mysore State, Bangalore.
24	Sheep breeding in Mysore.	
25	Poultry in Mysore.	
26	Bee-keeping in Mysore.	
27	Instructions for Improvement of Animal Husbandry by Livestock Expert	
28	Report on Improvement of Sheep Livestock Expert.	
29	Livestock Work in Mysore.	

APPENDIX VIII (*Continued*)

Serial No.	Name of Publication	From whom received
30	The Serum Institute, Mysore.	Director of Agriculture, Mysore State, Bangalore.
31	Some Do's and Dont's in Poultry breeding.	
32	Mysore Agricultural Calendar.	
33	Cattle and Sheep breeding in Kanarese.	
34	Feed & Work your Cow, by R.W. Littlewood.	Director of Agriculture, Madras (Leaflets and Broad hints)
35	Dedication of Breeding Bulls by R.W. Littlewood	
36	Leaflet. Prizes for Calves from Premium Bulls by S. V. Ramamurti.	
37	Rations for Milch Cow etc.	
38	Breeding Bulls and Management by Littlewood.	
39	Cattle Breeding, R. W. Littlewood.	
40	Practical Hints on Bee-keeping.	Govt. Entomologist, Coimbatore.
41	Enemy of Indian Honey bee.	
42	Indian Bee-keeping and Suggestions for improvement.	
43	Research and Propaganda in bee-keeping.	
44	Swadeshi–True and False.	Harijan Office, Poona.
45	Report of Lucknow Co-operative Milk Union for 1939.	Registrar, Co-operative Societies, U. P.
46	By-laws of Lucknow Milk Union.	
47	Do (in Hindi)	
48	Report of Co-operative Milk Union, Coimbatore (in Tamil)	Secretary, Co-operative Milk Union, Coimbatore
49	By-laws, Do.	Do.
50	Milk Supplement of Daily Telegraph, London.	M.R. Ramaswami Sivan.
51	Report on Marketing of Eggs,	From the Office of the National Planning Committee.
52	Annual Report of Marketing Officers, 1938	
53	Dr. Wright's Report.	

RESOLUTIONS OF THE NATIONAL PLANNING COMMITTEE ON THE REPORT OF THE SUB-COMMITTEE ON ANIMAL HUSBANDRY AND DAIRYING.

The Final Report of the Animal Husbandry and Dairying was presented by Sir Chunilal V. Mehta, Chairman of the Sub-Committee, on the 4th May 1940. The Secretary, Rao Bahadur M. R. Ramswamy Sivan, was unable to be present. Discussion continued on the 8th May. The following resolutions were passed.

India has the largest proportion of animal population in the world, a considerable proportion of which is useless and burdensome. Means must, therefore, be found by sterilization and by other ways to reduce the size of the present cattle population, and also to guard against the increase of useless animals in the future. Though the number of animals is the largest in India, the produce per animal is miserably poor. Means must be found to increase this produce per animal, and to make the cow an economic proposition, and to cheapen the cost of cow's milk and milk products. With this end in view, while generally approving the Report of the Committee on Animal Husbandry, the following recommendations are made :—

1. The first essential is the breeding of pedigree cattle suitable for regional areas with a view to distribute the bulls and cows on the premium system throughout the villages. The responsibility for doing this must rest with Government.

2. The objective of breeding should be what is known as the general utility or dual purpose animal, as India is an Agricultural country requiring bulls for cultivation, though the combination of milk and draught characteristics, including for agricultural operations, may mean some sacrifice in both to a certain extent. This policy is also necessary because animals cannot be bred for slaughter in view of the strong sentiment in the country in this matter.

3. Breeding should be done by selection from indigenous stocks as the experience of crossing with foreign breeds has not been happy.

4. Legislation on the lines of the Punjab and Bombay but with its provisions considerably strengthened, should be undertaken for sterilising bulls and ringing cows which are found to be useless and superfluous, with a view to replacement ultimately by pedigree animals.

5. The system of dedication of Brahmani Bulls should be carefully watched, so that only proper bulls, and ultimately pedigree bulls, are selected with the help of village panchayats, and with the approval of the Animal Husbandry Authority.

6. The question of Government Cattle Farms, Co-operative Organisation for Cattle Breeding and for Milk Production, Transport and Processing, and for the Distribution of Premium Bulls, have been recently examined in the Report of the Expert Cattle Committee, Bombay, 1939, whose recommendations may generally be taken as the basis of work, *mutatis mutandis*, in other Provinces and States.

7. Proper provisions should be made for fodder, controlled grazing, silage, throwing open of forest areas, where feasible, and by legislative insistence, where practicable, on the cultivator setting apart a portion of his holding for fodder crops.

8. Good animals require good food, and the question of animal nutrition requires further research.

9. Cow's milk is an excellent article for diet for human consumption, and surpasses buffalo milk. When the arrangements mentioned above have been made, and sufficient quantity of milk can be provided, there should be a "drink-more-cow's milk" campaign, especially in cities, where the taste has been developed for buffalo milk. The creation of a demand for cow's milk will be a great support to the Dairying Industry. Buffalo's milk is preferred because of its fat content The objective of breeding should aim at increasing the butter content of cow's milk which can be done. This will also help the use of cow's milk for ghee manufacture for which there is a demand in the country.

10. Profitable production of pure milk and milk products is greatly handicapped by the unfair competition of unscrupulous vendors and distributors of adulterated articles. There should be adequate provision of law against this, and it should be strictly enforced. The competition of what is called vegetable ghee should be provided against. It is desirable to give a generic name to these hardened oils, and the use of the word "ghee" should be prohibited for these products. Some distinctive colour should be given to these products at the factory, so that they cannot be mistaken for "ghee". The distinctive colour may be such as not to affect the colour of the cooked food.

11, Dairies should be removed from cities to rural areas at a suitable distance from them, both because the cost incidence in cities is high, and because it leads to the slaughter of our best animals as well as to the cruel and disastrous process of phooka. Transport facilities should be given.

12. Slaughter houses should be strictly controlled by a Veterinary Officer, who should see that no animals that are capable of being useful are destroyed. Regulations should be made to provide against the slaughter of animals serviceable for agriculture and for milking purposes. The objective should be to make the keeping of animals an economic proposition.

13. Pinjrapoles and Gorakshak Mandals who derive their funds from trade should be persuaded to take up cattle breeding at least as a part of their activity.

14. In tracts where male buffaloes are used for cultivation and transport, attention should also be paid to the breeding of good buffalo stock.

15. Much more attention should be paid to animal husbandry as an important department. The subject of Animal Husbandry should find a place in the curricula of the appropriate educational institutions. Research in all branches of Animal Husbandry and Dairy Produce should also be encouraged.

16. Timely prevention of cattle disease, control of epidemics, and compulsory inoculation are recommended. More research is required on animal diseases.

17. The Committee are of opinion that there is scope in this country for manufacturing milk products like Casein, Skim Milk Powder, Condensed Milk etc. which are now imported; and this industry should be safeguarded. In the manufacture of ghee it should be examined whether the preparation of it from creamery butter is not as good as, or better than, the deshi method from whole-milk curds.

18. The Sub.Committee's recommendations with regard to the breeding of sheep, goats and poultry, and also with regard to Bee-keeping, are generally approved.

QUESTIONNAIRE

ON ANIMAL HUSBANDRY AND DAIRYING ISSUED BY THE NATIONAL PLANNING COMMITTEE AS GIVEN IN RED BOOK I

(1) What do you consider to be an adequate standard of living in your Province? What steps do you consider to be desirable and feasible, (a) by the development of the existing agricultural and industrial resources of the Province, (b) by establishing new industries, (c) by working up to the maximum capacity the existing ones, as well as (d) by improving agricultural production, it may be possible to attain that standard?

How would you provide for measuring the degree of growth from time to time in all these lines of development?

N. B.—By a standard of living is meant the provision of sufficient food and nourishment, as well as other necessaries of life and work, and such other social services and amenities, like public education, care of health and sanitation, amusement and recreation, which, between them, make up a reasonable standard of civilised life.

(8) What are the principal sources of production in your Province in respect of Animal Husbandry?

(9) Has any Census of Production ever been taken in all these several respects, and, if so, what is the net per capita income in terms of commodities and services reduced to a common denominator, i. e. money?

(10) How far is your Province a deficit or surplus Province. or self-sufficient, in the matter of

(*a*) Food supply.

(*b*) What industries are there for which (1) raw materials are available locally, or (2) have to be imported from outside.

(*c*) Consumption goods ?

N. B.—By Consumption Goods is meant articles or commodities needed for immediate consumption as distinguished from Production Goods which are articles or commodities needed as implements or machinery or raw material to aid in the process of production.

What are the staple articles of diet–such as food grains, fish, ghee, butter, oil, etc. (a) which go out of your province, and (b) which are brought in from outside into your province? Please give value and quantity.

(47) To what extent is the animal wealth of the province an aid to agriculture, and contributes to the general improvement of the food supply of the community and transport? What steps have been adopted for purposes of establishing new industries, or developing existing ones to their fullest capacity in the Province out of the animal wealth of the country, e. g. meat, dairy, hides, skins, hair, wool, teeth, tissues, hoves, etc.? What measures have been adopted to maintain and increase these sources derived from the animal wealth?

(48) Are there any "process" industries in your Province, and what room is there for the increase or further development of such industries ?

N. B.—By processing is meant working up a primary material into the next complete stage where it might he ready for further utilisation as raw material into finished goods immediately ready for consumption, e. g. wheat into flour.

(50) In what direction is it necessary to extend in your Province the principle of agricultural insurance to guarantee the agriculturist against the main risks of his occupation, e. g. shortage of rains, failure of crops, of fodder, pests, weeds and floods, diseases amongst plants and cattle, etc. ?

What policy would you adopt to achieve any effective system of agricultural insurance throughout the province, as a unit by itself, or in collaboration with the rest of the country, applying to all forms of agricultural wealth, e.g. crops, animals, food and water, etc ?

(59) What are the principal industries which may be regarded as subsidiary or incidental to agriculture now being conducted in your Province? How and by whom are they conducted, and what is the result as regards the income of the community from this course?

N. B.—Subsidiary Industries are those industries which are dependent upon, or connected with, Agriculture as the Primary Industry, e. g., dairying, fodder-supply, or cattle manure.

(60) What room is there in your province for the increase or expansion of such industries subsidiary to the main industry of Agriculture? How would the Provincial Government aim to develop such new industries?

(61) To what extent would it be possible to adjust the working of such subsidiary industries to the convenience of the agriculturist class as a whole in respect of the seasons of work, the necessary raw materials, transport and marketing of such produce?

SUMMARY OF DEVELOPMENTS.
ANIMAL HUSBANDRY & DAIRYING

Several lines of development,-both on the side of agricultural improvement as well as of industrial advance,-have been indicated in the Sub-Committee's Report. Notwithstanding the impediment caused by the War, progress has been made on those lines in the years since the Sub-Committee reported. The main field for improvement, on the agricultural side lies in the (a) improvement of breed, and (b) control and prevention of animal diseases.

A. For the former purpose, Government in various Provinces maintain breeding farms of their own, where pedigree bulls are bred and reared. These are placed out in suitable villages, on a premium basis, let to farmers specialising in stock breeding. In Bombay, Herd Registers are maintained for eight of the famous breeds of the Province. Considerable progress has been noticed in these areas where such work has been undertaken The Bombay Livestock Improvement Act was passed in 1933, which is intended to prevent breeding of undesirable bulls or male stock, which has now been adopted by 112 villages. It needs to be extended on a much larger area.

Similar attempts at improving breed, and thereby the yield, are being made by the Imperial Council of Agricultural Research in regard to sheep and their wool The number of sheep in India has been estimated at 4½ crores, while the wool yielded by them is estimated to be 8½ crore lbs. This gives an average yield of some 1·9 lbs. But in the N. W. Frontier Province, Punjab, Sind, Baluchistan, Rajputana, United Provinces, and Western India States, the yield averages 3·1 to 4 lbs. per sheep; while in the rest of the country it seldom exceeds 1 lb. per head. Even the best of this can be increased; while the lower quality would have to be improved by proper breeding to the best level of today. Systematic breeding of sheep has, at the instance of the Imperial Council of Agriculture, been taken in hand for the 5 principal Indian breeds in the Punjab (Hissar), Madras (Hosur); and Bombay (Poona), with good results so far. The Wool Analysis Laboratory at Poona has systematised the methods of valuing fleece for effective breeding, and further research on wool fibre and its relation to sheep-breeding is being carried out with success. Australian rams have been imported in considerable number in the Kashmir State in recent years for breeding purposes, which it is expected will improve substantially the quality as well as the quantity of wool yield. This, it is believed, would be of advantage materially to the Woollen Textile Industry in the State and its neighbouring Provinces. Goat hair improvement for industrial purposes is also being prosecuted on the same lines. Goat is more used in India for food purposes than sheep; but a systematic, scientific breeding of sheep and goats for food purposes still lacks a place in the planned programmes of local and national development hitherto put forward.

There is, as already noticed, considerable scope for expansion in the Dairying Industry in India, and in its retail business. Compared to its cattle-wealth, and also in relation to the dietetic needs of its people, the production of Milk and Milk Products needs very much to be stepped up. One handicap in this regared is, no doubt, the vast distance in the country, and the lack of adequate and appropriate Transport, with suitable equipment for the preservation of such perishable goods in long transportation. In recent years attention has been directed to overcome this handicap. Opinion seems to be now unanimous that an effective solution of the problem will be found in the development of Co-operative Societies for handling and disposal of Dairy Produce. Large-scale Dairying, modern large-scale mechanised Dairy Farms, in place of the prevailing cottage industry in this matter, though now beginning to work on factory scale, is yet practically non-existent, apart from the Military Dairy Farms that have been maintained for its own purposes by the Defence Department in several parts of the country. Unless the production of Milk and of all Milk products is mechanised and industrialised, our potential wealth in this field must remain unexplored; and our people's needs remain unfulfilled.

One indispensable preliminary to this development is wider spread of knowledge on the subject, better education and training in its technique; and higher research. This need is perceived and is being gradually met.

The number of Agricultural Colleges, with special Departments for Dairying, have grown all over the country; while the Imperial Institute of Animal Husbandry and Dairying at Bangalore carries on advanced research in the problems affecting this industry and business. Pasteurisation of milk has commenced in some of the leading cities, where milk is sold in sealed bottles after being pasteurised. The volume of this trade is, however, still very small.

The greatest single handicap, however, against the fullest possible development of this Industry lies in the inadequacy of cattle food. The first essential to increase milk production in the country is, of course, better cattle; and better cattle can only be had if better facilities are found for feeding them appropriately, The land available, however, for grazing is limited; and until additional culturable waste is brought under the plough, this difficulty will remain. Proper planning of such additional land, as well as of the land now under cultivation,–and its better organisation,–will make up our deficit. The total production of roughage for cattle feed is estimated at 170 million tons, while our need is 270 million tons, on a decent standard of feeding. Similarly, our annual need for concentrates is estimated to be 15 million tons, while our domestic production of such food is only some 3.7 million tons. Until such deficiencies are effectively remedied, expansion and improvement in the Dairying Industry is impossible. The new Government of Independent India have not yet had a chance to settle down to such complex problems of co-ordinated national reconstruction: but they are not unaware of their urgency, all the more intensified because of the partition of the country.

(B) As regards the contagious diseases amongst cattle, the Civil Veterinary Department in the Provinces and important Indian States has become increasingly attentive to the matter, There are five Veterinary Colleges in India, namely, at Lahore, Patna, Calcutta Bombay and Madras; but their number needs to be still more increased. The principal Veterinary Research Station is at Mukteshwar in the United Provinces with a Branch at Izatnagar near Bareilly. It is a National Institution maintained by the Central Government; and has been considerably expanded in recent years because of the growing recognition of the importance of controlling, treating and eliminating cattle epidemics. A new branch was recently added to the Institute dealing with Poultry Research and Nutrition. Provincial Colleges also carry on considerable research in this branch.

Added to its research work in animal diseases, the Imperial Veterinary Research Institute manufactures large quantities of sera and vaccines for the use of the Provincial Departments as well as private Farmers to combat disease amongst cattle. Until recently it was the only munufacturing centre for this purpose. But new Institutes for serum have been opened at Madras and Bangalore also to manufacture biological products for the use of the local Veterinary Departments in the Province and the State respectively.

The most frequent animal diseases are glanders and surra amongst horses, mules and donkeys; and rinderpest, foot-and-mouth disease, haemorrhagic septicaemia, black water and anthrax amongst cows and buffaloes. Other diseases are of minor importance, e. g. tuberculosis, Jone's disease, and contagious abortion, though in recent years they have been known to be increasing in volume. Glanders is believed to be incurable but surra can now be successfully dealt with by Naganol. The disease affects also camels, cattle and dogs; but thanks to the new treatment, its further spread is restricted. All the other diseases particular to cattle, except the foot-and-mouth disease, can be controlled either by inoculation or protective sera or by vaccination.

Mukteshwar has recently produced an Anthrax "Spore" Vaccine, which helps materially to fight against the diseases.

Like cattle, poultry is also subject to many diseases of a contagious character; and the Research Institute attends to them as well. The so-called ranikhet disease is a widespread scourge, with serious ravages interfering with poultry–farming throughout the country. No treatment, however, whether curative or prophylactic, has so far been discovered as successful against this disease. The only remedy is strict hygienic measures to prevent its spread. Cholera and smallpox among fowl are also common; but vaccines are available against them, so that poultry can be effectively protected.

To guard against infected foreign cattle bringing any new disease or spreading old ones in the country, a special Legislation called the Live Stock Importation Act operates at all Ports, where the landing of imported animals is permitted, and where these animals are fully examined before they can be allowed to become part of the National Cattle Wealth.

The Veterinary Department treats sick animals, in special hospitals, and aids dispensaries for common ailments amongst them. These hospitals and dispensaries are maintained chiefly by Local Boards, with financial assistance from the Provincial Governments.

K. T. Shah

REPORT
OF THE
SUB-COMMITTEE ON FISHERIES

PERSONNEL OF THE SUB-COMMITTEE ON FISHERIES.

1.	Dr. B. Sundara Raj.	*Chairman.**
2.	Dr. S. B. Setna. M. Sc., Ph, D.	*Secretary.*
3.	Shri C. S. Krishnaswami Naidu.	*Member.*
4.	Shri Hemanta K. Sarkar.	,,
5.	Capt. N. N. Datta.	,,
6.	Travancore Government Representative Dr. C. C. John.	*Member.*
7.	Baroda Government Representative Mr. S. T. Moses.	*Member.*

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*Dr. Sundara Raj representing Madras Government was originally nominated as Chairman, but as the Madras Government, like the then Government of India, would not permit their officers to work on the Sub-Committee of the National Planning Committee, Dr. Sundara Raj could not function. It was only later when he was under the U.P. Government that he could function as the Chairman and has prepared this Report in that capacity.

INTRODUCTION.

The Report of the Sub-Committee[*] on Fisheries was presentd only in the beginning of 1946; and, as such, it has not been considered by the National Planning Committee as a whole, nor any Resolutions taken by that body thereon. The Report, moreover, having been prepared only in 1946, no new developments in that field need to be noted in a summary, usually added at the end of each Report.

The Sub-Committee was appointed to consider

(*a*) Inland Fishing ;

(*b*) Coastal Fishing;

(*c*) Deep-Sea Fishing;

(*d*) Pisciculture;

(*e*) Fish products, including Fish-Oil and Fish-Meal, dried and smoked Fish;

(*f*) Marketing of fresh Fish, including Cold Storage, and transport facilities.

The Report prepared by the Chairman, Dr. Sundara Raj, deals with all these matters; and is supplemented and commented upon by another member, Dr. John. The importance of fishing lies in the immense potentiality of that article in the food resources of this country. Notwithstanding the prevalence of vegetarianism, large numbers of every caste and creed in India are accustomed to use fish in their daily diet. There are some 5,000 miles of coast-line of India, where the 100 fathom line extends to considerable distance from the coast which provides a vast area for fishing. The great perennial rivers of India, and the innumerable tanks and reservoirs in the East and the South of the country, also afford further additions to fishing grounds. These, though exploited from time immemorial, lack scientific utilisation and development.

Certainly, in the case of coastal, and still more, as regards deep-sea fishing, the occupation is largely of a primitive character, carried on by ignorant, unorganised and ill equipped fishermen. Their technique is rudimentary, their tackle elementary, their capital equipment slight and inefficient. The possibility of the existing enterprise being turned into factory-scale production, in mass of edible, or commercial fish, remains still to be tried. Several Provincial Governments, like Madras and Bombay, have, it is true, made experiments in recent years to build up this industry on a modern, mechanised scale; but the experiments still remain unconverted into commercial propositions. In these days of extreme food shortage, the neglect of this abundant and unfailing source of supplementing or adding to the food supply of the country would be unpardonable, even apart from the very high place this subject should normally occupy in a scientifically planned national economy for this country.

In a special Sub-Committee Report on **Priorities in Planning** issued at the commencement of 1946, the matter has been dealt with at considerable length,—mainly, of course, from the standpoint of the food value of the article. Indian rivers, lakes, ponds and coastal waters are immensely rich in all varieties of edible as well as commercially valuable fish, i.e. those whose oil or other products have a commercial value. Fish is a perishable article, under ordinary circumstances. But even apart from the modern methods of fish preservation under cold storage and special transport, traditional methods in India have been in vogue from time immemorial to salt and smoke and dry the fish, so as to be available for use some time after the catch.

Industrially exploitable fish, like cod or sardines, need to be caught on a large scale by modern mechanical equipment, before a suitable industry can be developed in these directions. The deep-sea around India has larger fish like sharks, and whales; but this country, with its rather primitive fishing enterprise, has not entered in whaling or fishing for larger types for industrial purposes, e. g. the skin, bone, guts etc. of such fish. Large-scale enterprise, under Government protection or subsidy is necessary to develop these on a proper scale as part of the National Plan.

The use of Fish for manure in orchards and gardens for the enrichment of certain varieties of fruit, though practised, needs also to be systematically expanded. All that is impossible of achievement, without a Scientific Plan, in which each item would be correlated and co-ordinated with all others in any way connected with it; and all integrated into a comprehensive National Plan, simultaneously put into effect on all fronts all over the country.

Commercially very valuable fishing consists, besides those already mentioned, of pearl fishing. The waters of the gulf dividing India from Ceylon, and of the Arabian Sea near the edge of the Kathiawar Peninsula, as well as in the Gulf of Cutch, are rich in Oyster beds, yielding highly valuable pearls. This has been exploited from very ancient times. The cultivation of oyster beds on a scientific basis; the preservation of these beds from indiscriminate and predatory enterprise; the careful breeding of oysters, are all matters, which are but slowly receiving the attention that is their due from the Indian Government. With the advent of a truly National and Popular Government operating in the real, long range interests of the Indian people, we may well expect an intensifying and expediting of such endeavours, so that wherever national prosperity has a chance of development, the opportunity may be fully utilised.

Pisciculture of ordinary edible fish, as well as those commercially valuable for their yield, needs intensive attention and scientific treatment from the authorities. It must be an integral part of a National Plan. Trout and salmon are being cultivated and specially bred in places like Kashmir, the Nilgiris, and other suitable spots. These, however, are more for "sport" than as a commercial proposition. Such attempts as have been made in this direction must be co-ordinated and integrated into a common national enterprise, conducted through the classes traditionally following the occupation; but superintended and co-ordinated into a consistent national whole by supervision and regulation from above.

Reference has already been made to the possibilities of fishing being properly developed, as a source of new industry besides adding very substantially to the food supply of the country. These industries,—at least such as would be on a modern, mechanised, mass—production scale,—are comparatively new in the country. There are very little vested interests of private individuals or corporations in this business. It must, consequently, be established, conducted and developed as public enterprise, owned and managed by Government, whether of the Province concerned, or the Central. No room, should be left in this important industry for private profiteering. It would then be easier, and more just to the people as a whole, if the Fiscal Policy is revised and adapted to the needs of this Industry.

Such ingredients, moreover, as salt, needed for fish curing and preservation, should be free from any tax-burdens as were imposed in the British era of our history. The Salt Duty has, it must be added, been abolished even by the first Indian People's Government,—the so-called Interim Government of India, which was preparing the ground for the ultimate ndependence of the country; and the precedent set by it will, it may well be hoped, be maintained by their successor. What, however, was done by the Interim Government as an *ad hoc* measure, to satisfy the demand from the most important political leader of the country, must be carried on as an integral part of the National Fiscal Policy and Financia Administration, so that the aggregate all-round well being of the country may increase, without any section suffering for the benefit of another.

K. T. SHAH.

REPORT OF THE SUB-COMMITTEE ON FISHERIES

Fisheries as a food producing industry when fully developed should rank equal to Agriculture. Since the time of Dr. Day, in the. seventies of last century, fisheries have been a Provincial concern, especially after they became a 'Transferred Subject' with the reforms of 1919-20. Of all the Provinces, Madras has the oldest and the best organized Fisheries Department. Bombay, Bengal, Bihar, Orissa, Punjab, Sind, U.P. and C.P., and the States of Travancore, Cochin, Mysore, Hyderabad and Baroda, now have their own Fisheries organizations of varying sizes. In the absence of one Central policy and control, there has been over-lapping, duplication and waste of effort and expenditure. Also inter-provincial jealousies and disputes have sometimes prevented the attainment of maximum results. To mention only one example: Fishing monoplies for *chanks* worth lakhs of rupees exist in Madras; but the industry survives only in Bengal, and arbitration of the mutual interests to the best advantage of India as a whole should be a Central concern. The fisheries of rivers and oceans are not bound by political boundaries. Taking India as a whole, the major problems of fisheries, marine and freshwater, are similar if not identical throughout the country. In fresh water the common Indian fish are carp and catfish, of the same or similar species. Monsoon inundations and severe summer drought occur in the North and South. The problem of water supply, the principal factor governing inland fisheries, is therefore the same. The important food fish breed normally in rivers. Thus rivers are the primary source of freshwater food fish everywhere in India. As most rivers traverse more than one Province, they create inter-provincial problems of administration, conservation and development. Even more similar are marine fishery problems. Our prime sea-fish such as Seer, Pomfret, Jew-fish, Perch etc. are the same, or only slightly different, all round the coast. Shoaling and midwater fish preponderate almost to the exclusion of the bottom fish so important in Northern latitudes. Sea and weather conditions are the same. As regards handling and curing methods and the public taste for fish commodities, they are not very dissimilar throughout the country. Railways, so important in developing markets, are an Imperial concern. Any improvement in methods of preservation, transport and development of markets would apply throughout India.

Central Fisheries Organization.

The need for a Central Fisheries Organization therefore has been increasingly felt. In response to this demand, the I C.A.R. has established a commodity committee for fish, and has been financing a few fisheries schemes in the Provinces and States. The most recent authoritative demand for a Central organization was made by both Indian and Overseas scientists who assembled at the Jubilee Session of the Indian Science Congress in 1938. Two Fisheries Committees were then formed, one in India and one Overseas, to press for the recognition of the claims of fisheries by the Government of India. Fisheries being a transferred subject, the Government of India declined to move in the matter. The exigencies of war, however, caused them to modify this attitude, and the Central Government have been taking active steps during the last 2 or 3 years to develop fisheries on an All-India basis. Inspired by the awakened interest of the Government of India, several plans for Post-War Development have been formulated. According to a recent news-paper report, none of these was found satisfactory : and the Government of India are reported to have asked for a British Expert to plan fisheries. This is not surprising, as schemes have been drawn up by all and sundry.

Five Cardinal Principles.

Any constructive plan for the future development of fisheries on an All-India basis must conform to the following Fundamental Principles:—

1. The functions of the Central & Provincial Organizations should be defined.

Before planning for the future it is necessary to define clearly the functions of the Centre and of the Provinces and States. A confusion here is apt to blur the picture ; and this what has happened in the several plans put forward. The l-India Organization should be responsible for :

(a) planning, financing (partly or wholly), coordinating d directing Fishery Research (Scientific and Technological) roughout the country, besides itself undertaking research basic problems ;

(b) initiating well-considered and uniform fishery islation for the country as a whole; local acts, rules and ulations being framed by the Provinces and States with the nsent of the Government of India ;

(c) dealing with inter-provincial fishery disputes ;

(d) controlling exports, imports and market prices ;

(e) training fishery officers and apprentices. Though the present only short term and mostly practical training ll be possible in the Central Fisheries Research Institutes, as work expands, full degree courses will have to be instituted some of the Universities, working in collaboration with hery Research Stations.

The Provinces will continue, as at present, to carry out al administration of fisheries, enforce laws and regulations, lect fishery revenue, generally supervise trade and industry, lect statistics, introduce and popularise reforms, and carry t social economic programmes (co-operation and education) the uplift of the fishermen.

Fishery research, if done by Provincial institutions, should m an integral part of the All-India Research, guided, ntrolled, and if necessary, financed, by the Centre. During last decade, experience of schemes financed by the C. A. R. has proved the urgent need for closer supervision d control of research in the Province and States, if time, ort and money are not to be wasted, and definite objectives to be achieved.

2. **The development of the fishing industry should be in interests of both the producer and consumer.**

Fishing is an age-old industry in India, and a large pulation is engaged in it. No revolutionary reform that is likely to supplant the fisherman, and deprive him of his livelihood is possible, and, even if possible, is desirable in the present state of the country. This does not mean that development on modern lines is altogether precluded. Without such displacement it is possible to develop the industry on up-to-date lines to a considerable extent. The largest addition to fish production in India is anticipated from deep sea fishing, which is untouched at present. (The so-called 'Deep sea fishing' off the coast of Madras, accounts of which have appeared recently in the press, is not deep sea fishing in the real sense of the word). There is a large demand for fresh fish in the interior of India, which could be met by deep sea fishing aided by refrigeration and transport on modern lines. This should not interfere with the present inshore fishing industry and trade on which the Indian fisherman at present depends. Ultimately he also will benefit from the proposed scientific and industrial research on improved fishing methods by the Centre and the demonstration and popularisation of these by the Provinces and States.

3. Foreign Experts.

Fisheries in India suffer from the serious handicaps of an almost total absence of qualified .and experienced fishery experts. The officer who is commissioned to plan the development of Indian fisheries, and execute the plan, must combine sound academic qualifications in fisheries science and world-wide knowledge of fisheries with an intimate acquaintance with and practical experience of Indian Fisheries. Tropical countries all round the world are practically undeveloped, and Indian fisheries therefore present novel problems. Accepted methods of northern countries are not applicable here without modification to suit local fishing conditions, and not always then. Only persons who combine technical qualifications with actual experience of local problems could be of immediate service. Foreign experts with intimate acquaintance of Indian problems and conditions were difficult to find even before the War; and now they are so much needed in their own countries that they are not likely to be spared. A person with technical fisheries qualifications, long experience of local problems and conditions will have to be found in India for the task. For specific technical jobs, such as canning, curing and deep sea fishing etc., it is necessary and should still be possible to commission skilled technicians from abroad, who have been brought up to the trade to train local talents.

There is an impression in some quarters that the Japanese model would be the most useful for developing Indian fisheries, but a personal visit and careful study of Japanese fisheries will convince anyone that there is nothing original that Japan can provide. Their modern fishing industry is entirely based on Chinese and European methods.

4. **Work and experience in the past should count in planning for the future.**

Post war planning should not ignore the data already available from 40 years' work in the Provinces. For instance, in the memorandum of the Government of India, 'Post-War Development of Indian Fisheries', it is proposed that a preliminary enquiry should be conducted by a staff of five graduates after two months' training. The elaborate enquiry conducted by Day published in 1873, and the more detailed surveys by Fisheries Officers and Departments in Bengal, Madras, Punjab and the United Provinces with their recommendations and conclusions, are already available ; and half a dozen raw graduates are not capable of producing better results. In addition considerable work has already been done in the major provinces and some of the States. The scientific and industrial experiments conducted in the Provinces, particularly in Madras, during the last 40 years, have yielded notable results. To cite only two examples : (1) The development of the fish oil and manure industry led to the establishment of no fewer than 647 factories along the West Coast of the Madras Presidency. (2) The discovery in Madras of fish liver oils of high vitamin potency paved the way to commercial exploitation of the so-called "Shark Liver Oil." If time, effort and money are not to be wasted, stock must be taken of the results already obtained, and the stages reached where planning for the future has to begin.

5. Financing Fisheries Schemes.

Research on so essential a food industry is a necessary charge on the public purse. Development schemes however should be increasingly financed by the Industry itself. A general tax in the undeveloped state of the fishing industry, which for the most part is in the hands of an impecunious backward class, is not advocated. Moreover it will be a direct tax on food. Where however large scale industries have been started, such as the oil and guano factories on the West coast, and the new Shark Liver Oil Industry, and when the proposed deep sea fishing industry comes into being, in all of which the margin of profits is large enough ; and where valuable crown monopolies exist such as the Pearl & Chank fisheries of the Madras Government, revenue is both possible and desirable to provide funds for further advancement of the industry. In India, however, the scope for such revenue is limited, because of the primitive state of the fishing industry. There is, however a source which could be tapped if direct revenue from fisheries as such is to be raised for development schemes. There is a considerable disparity between market price paid by the consumer and the cost price realized by the prime producer, the fisherman. If a portion of this middleman's profit could be made available by a sales tax or cess for the development of the industry, it would be a larger and more assured source for reinvestment in improving the industry. The most conservative estimate of production of fish in India is that of the Government of India's Marketing Enquiry. It was computed that Rs. 1,045 lakhs was the landed value of fish caught. A cess of even ½% i. e. less than 1 pie per rupee should provide Rs. 5 lakhs for development. Therefore the plan outlined below includes fixing of prices and control of trade and marketing as an integral part of the schemesl Control of prices and marketing have been tried in Allahabad during the last two years, and have proved successful.

Recapitulation of Principles.

The five principles enunciated above may be briefly stated as follows :

1. The functions of the Centre and of the Provinces should be clearly defined.

2. The indigenous fishermen are not to be deprived of their livelihood by any sudden revolutionary reform. Up to date methods are recommended for deep sea fishing, and for internal trade, neither of which is likely to affect the indigenous industry. Simultaneously experiments with improved craft and tackle so as to introduce gradual reforms in the traditional methods of fishermen should be undertaken.

3. Planning and execution of the plan should be entrusted to thoroughly well-qualified officers, with local experience. Foreign experts are to be employed for specific technical jobs.

4. Plans must be based on the data collected and results obtained in the course of 40 years fisheries administration and research in the Provinces and States.

5. As the Indian fisherman is at present too poor to provide funds for development, and taxable large scale fishery industries are scarce, and will be so until deep sea fishing on modern lines is developed, it is suggested that the middleman's profit may be tapped by the levy of a cess or sales tax. The control of market prices will prevent the middleman from passing the cess on to the producer or consumer.

THE PLAN

A diagrammatic scheme of the Central Organization to be set up with research and experimental stations and superior staff is appended.

Consistent with the principles enunciated above, the following organization at the Centre is proposed:

1. A Fisheries Executive Council.
2. A Fisheries Advisory Board.
3. A Commissioner of Fisheries and his staff.
4. Central Fishery Institution and a fishing fleet.

In addition 5 existing Provincial Fisheries Stations will have to be subsidised and brought into line with the All India Scheme, and one at Chittagong established.*

(1) An All-India Fisheries Executive Council.

This will consist of Ministers of Provinces and States holding fisheries portfolios, presided over by the Minister or Member of the Central Government administering fisheries. This will be the final executive authority for approving and sanctioning All India Schemes for fishery-research and administration.

(2) Advisory Board.

It is necessary to have a thoroughly representative Advisory Board of Fisheries with power to co-opt members when required, to ensure co-operation and co-ordination of work between Government, Industries, Universities and Technical Institutions; and to provide for development on an all-round basis and ensure research on the urgent and real problems of the industry. It will consist of:

1. The Commissioner (see below) as President.
2. Chief Fisheries Officer of each Province & State.
3. Representatives of the Larger Fishery Industries.
4. One representative of the Board for Road and Rail Transport.
5. Professors and Research Workers, specialising on fish and fisheries.

The Board will discuss all proposals and schemes and make recommendations.

A Commissioner. He will be the controlling and coordinating authority for the research and administration conducted by his staff and institutions. He will also guide and correlate work in the Provinces and States. His duties will be:

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*Since the Partition of the Country in August, 1947, this will no longer be a responsibility of the Indian Government.—*Editor.*

1. President of the Advisory Board, and Secretary, and Technical Adviser of the Executive Council.
2. Oversight of research, both technological and biological. including deep sea fishing experiments.
3. Arbitration of inter-provincial disputes.
4. Drafting of suitable legislation.
5. Collection and collation of fisheries' statistics which are essential for research, administration and trade.

Hitherto the only institutions which collected fishery statistics on a comprehensive scale were the Fish Curing Yards in Madras and possibly in other areas, which purvey duty free salt for fish curing. The suggested organization for controlling markets and other Provincial or State Fishery Officers should in addition collect statistics and forward them to the Chief Statistician at the Headquarters in Delhi for compilation and publication. For convenience the marketing staff will work under the administrative control of the Provinces and States

(4) Institutions & Fishing Fleet

Fisheries fall under three heads, Freshwater, Backwater or Estuarine, and Marine. With few exceptions the fish inhabiting fresh, brackish and salt waters are distinct, and the problems relating to their development are consequently very different and need separate investigation. For the proper development of Indian fisheries, therefore, research stations are needed. In addition a Technological Institute for fishery industries and fishing fleet of vessels for deep sea work would also be needed.

A. Freshwater Fisheries Research Station,

To be located in Bengal for the following reasons:

1. The entire population eats freshwater fish.

2. Innumerable perennial ponds, lakes and jheels and a net work of rivers and canals provide ample facility for freshwater fishery development.

3. An indigenous form of fish culture already exists.

4. Most of the freshwater food fish of Northern Indi are represented in Bengal.

Since most of the freshwater food fish of Madras are differ ent species, it will be necessary to have a subsidiary station i South India to be located in Madras, where :

(1) Considerable work has been done in several fis farms :

(2) A Research Station has already been establishe sponsored by the I. C. A. R.

B. Estuarine and Backwater Fisheries Research Station.

Practically no work has been done so far to develop thes important fisheries. The fishery research station proposed fo Bengal will have in addition to Freshwater a section fo Brackish water engaged in marine fishery development and also a great port. Whatever facilities exist for research ma be brought into line with the All-India Research.

Bombay is the seat of a University and has a goo harbour and the Royal Institute of Science is at presen working on Bombay plankton with the financial help of th I. C. A. R. The Fisheries Department is engaged in som technological research and is proposing to have an aquariu and laboratory with research vessels Full advantage shoul be taken of all these activities by the All India Researc Organization.

On the East Coast the inland seas of Palk Bay and th Gulf of Manaar receive a large influx of fresh water and hav fish and fish problems peculiar to themselves. The Madra Fisheries Department have established a laboratory fo research at *Krushadai Island*, Pamban, which will have to b subsidised, staffed, equipped and brought into line with th All India Scheme.

Madras has harbour facilities and is the seat of University with a marine biological station and a publi aquarium (temporarily closed). Here also work on plankto is now carried on under the aegis of the I. C. A. D. These should be brought into line with the proposed All India Scheme.

Vizagapatam is the seat of a University and has a good harbour, and marine fishery research must be initiated by the provision of trained personnel and equipment in collaboration with the University and local fisheries staff.

Chittagong is the most Eastern port and should have a subsidiary marine laboratory for making collections and observations at the head of the bay. As there is no provincial station at Chittagong. one will have to be established in collaboration with the local Government.

These Six subsidised regional laboratories in Karachi, Bombay, Krushadai Island, Madras, Vizagapatam and Chittagong pretty well cover the entire coast line of India.

Laccadives & Andaman Islands.

Valuable food, pearl and shell fisheries as yet little exploited, exist in the Laccadives and the Andamans. It will be desirable as soon as possible to establish subsidiary marine laboratories on these islands as well primarily to investigate problems of pearl farming. At the Madras fisheries laboratory for pearl research on Krushadai island preliminary work on pearl farming and artificial culture of pearls has already been done with gratifying results. With the abolition in 1940 of the Fisheries Directorate in Madras further research practically ceased though the station is maintained. In view of the great potentialities of pearl farming and the possibility of transplanting into the Andamans, Nicobars and the Laccadives the gaint Australian oyster for a mother of pearl industry from the adjoining Mergui Archipelago (Burma), Krushadi Island Station and pearl farm should be brought into line with the All India Fisheries Scheme,

All these stations will continuously make local collections, record observations and make preliminary studies under the guidance and with the support of the Central Fishery Research

Stations at Cochin where the collections and observations made will be finally studied and conclusions drawn to formulate legislation and measures of administration, conservation and development for India as a whole.

D. Technological Institute

An important branch of the Central Research Stations to be established at Cochin will be an experimental station for technological and industrial Research. ·The experimental station will engage in research on industrial processes concerned with methods of fishing, handling, preservation, storage, manufacture of fishery products, transport, distribution and final utilisation of fish and fishery by-products In view of the large wastage that occurs through gluts and lack of efficient transport and through inefficient methods of handling and preservation, improvement of indigenous fish industries and the introduction of new methods of handling, preservation and distribution of fish and fish products, and improved hygiene are as imperative as improving methods of capture, if not more so. During the last 40 years the Madras fisheries department have carried out considerable work in fishery technology despite the lack of up-to-date apparatus and qualified staff at their experimental station at Tanur (now closed) and the Chaliyam Cannery (which has been sold). In planning the work of the new station all this will be taken into account.

1. Fishing methods, craft and tackle

Deep sea fishing is expected to provide the largest addition to fish production in the country. Most of the work connected with deep sea fishing experiments will necessarily be done by the fishing fleet (see below) Deep reservoirs swift flowing rivers and weedy lakes are not exploited by fishermen. Methods of fishing deep inland waters have to be developed and will form one of the duties of the fresh and brackish water station in Bengal with the expert advice of foreign technicians of the fishing fleet. Here also due account should be taken of the research already done in Madras.

2. Methods of Preservation

The bulk of the catch is sold as fresh fish and therefore refrigeration has a great future in the fishing industry. A considerable trade with the interior market in iced fish has developed. With the proposed development of deep sea fishing this method will be inadequate and refrigeration on modern lines will have to be introduced Some experiments in icing as well as freezing fish were done at the Madras experimental station at Tanur, and subsequently a patent method of refrigeration using nothing more elaborate than the usual ice-makidg machine was developed by a private concern in South Kanara with the technica ladvice of the Department for fresh fish supply to Bombay and Mysore. Refrigeration and cold storage will form part of the technological institute to continue the research.

3. Curing and Dehydration

There is a large indigenous trade in cured fish. The improvement of indigenous curing methods has been the subject of prolonged experiment and study at the Tanur Station which has resulted in some improvement in the methods adopted in the Madras public fish curing yards, further investigation of the methods and processes will have to be undertaken by the proposed technological institute.

4. Fish Canning.

There is at present no great demand for canned fish but a considerable amount of canned fish is imported from abroad and there is also a potential export market. The Madras Government cannery near Cochin which did pioneer work is now a private concern. For further experiments it may be necessary to subsidise it in order to carry through experiments and research.

5. Subsidiary Industries,

The most important are those concerned with oil and guano. Here again Madras has done yeoman service and 647 private factories for oil and guano have come into existence, manufacturing several thousand tons worth half a crore of Rupees in good years.

A further development in fish oil industry was the discovery of high vitamin. A concentration in some Indian fish liver oils which since 1940 has led to large scale development in several maritime provinces and states. Research unfortunately has been abandoned since the preliminary experiments of 1928-40. Medicinal oil manufacture has taken vast strides in western countries, and oils of greater potency than Halibut oil have been discovered in certain fish. As closely related fish exist in India further research on medicinal fish oils is warranted and may revolutionise this industry. The breeding and culture of the Indian pearl oyster in captivity having been accomplished and some preliminary experiments in inducing pearl formation having been done at the Krushadai Research Station, the possibilities of establishing a cultural industry on the lines of Japan will have be investigated and for this purpose the pearl farm at Krushadai Island will have to be investigated and the station strengthened. Many other minor industries such as the manufacture of buttons and ornaments glue, gelatine, trepang, pearl essence and iodine will have to be investigated.

D. Fishery Fleet

A fleet of fishing-boats for survey, research, and industrial experiments of capture, handling and transport of catches to the shore as well as to provide a training ground for officers and trade apprentices, is an absolute necessity, especially as the whole industry for deep sea fishing has to be developed from the beginning. At present no Province or State is engaged in Deep sea Fishing. With the possible exception of a few stray experiments in Madras with other craft and gear, trawling is the only deep sea fishing that has been tried in India. Short-lived experiments in trawling were conducted by the 3 Presidencies. It is clear that the Provinces and States by themselves have neither the resources nor the vision for the sustained investigations necessary for developing the industry. Also the deep sea fishing problems are common to the entire coast. Research on deep sea fishing must therefore be the concern of the Central Government if overlapping and waste is to be avoided. In contrast to the plan under the consideration of the Government of India which proposes the establishment of six centres simultaneously all round the coast for deep sea fishing experiments, the plan here put forward envisages only one such centre for initial experiments for reasons both of economy and efficiency. Modern deep sea fishing methods are technically among the most difficult, and demand the most expensive craft and gear. They involve navigating of ships of different designs, using nets and long lines of different kinds, in different depths and seasons and weather with and without machinery with the skill and knowledge bred of long practice by fishermen whose sole business it is and who pass their lives in it from boyhood to old age. Such men will have to be recruited from abroad first to conduct experiments to decide on the best types of craft and gear and methods for Indian conditions and then to train apprentices selected from Indian sea-going fishermen. It is necessary therefore to conduct such experiments in one locality under the close supervision of skilled technicians before any attempt is made to popularise methods or test the sea all round the coast. Cochin, which adjoins the best known fishing bank in Indian waters, provides the most suitable base from which to conduct these experiments. The Fishery Fleet will consist of the following vessels:

1 A Fishery Research Trawler—Drifter.

This should be a well found, all weather boat of trawler-drifter design, with accommodation on board for scientists and laboratories. It will carry out plankton, hydrographical, meteorological and other scientific research on the high seas for the Central Research Station and in addition undertake a systematic survey of fishing grounds. It will not usually engage in fishing experiments except full scale trawling with other trawls when necessary. The trawling experiments so far conducted in Bengal, Madras and Bombay have shown that trawling is not the best method for Indian economic conditions, fish and waters and consequently the trawling experiments are expected to be few.

2 **A large seine and drift net motor boat,** which will engage exclusively in deep sea fishing experiments with a

beam trawl Danish Seine net, drift nets, ring and purse nets and long lines. Only after these preliminary tests and surveys can the most suitable design of fishing boat rig, gear and method for India be determined. Simultaneously such small craft and tackle as will be within the reach of the local fishermen for inshore fishing suited to our harbourless surf beaten coasts but of a better type than the canoe or catamaran will also be designed by the same experts.

3 **A small fast motor carrier boat,** will actively assist in these operations and in transferring catches without delay to shore for further study or sale. After the best methods of fishing, craft and tackle for inshore and off shore have been thus determined by experiments, the Provinces and States must be induced to undertake propaganda to attract capital and introduce the methods in their respective areas. The necessary technicians for working these methods will be trained on board the fleet.

4 **Small motor boats.** In addition to the above three boats each of the five subsidiary fishery laboratories should have a small sea going motor boat for making collections and recording observations out at sea.

Research Staff

As the intricate problems of fisheries require research in a number of sciences, as biology, geology, hydrography, physics, and chemistry. meteorology, biometrics and statistics, a full complement of scientists representing all these sciences will be needed at the main and subsidiary stations. For details see plan. For deep sea fishing a qualified and experienced master mariner and trawler captain will have to be recruited from abroad along with three master fishermen for seine netting drifting and long lining, each of which has its own specialists.

NOTE SUBMITTED

BY

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The report prepared by the Chairman of the Fisheries Sub-Committee of the National Planning Committee is based on the principle that the fishing industry in India can be improved and expanded only through the establishment of a Fishery Executive Council, a Fishery Advisory Board, a Commissioner of Fisheries and his staff and a Central Fishery Institute and a Fishing Fleet. Though I fully agree that Technological and Biological researches are essential for providing technical and scientific advice to the fishing industry, I feel that the most fundamental need is the development of the industry itself on the basis of sound commercial principles with a view to eliminate waste, increase production and ensure proper distribution, without over looking the interests of those engaged in the industry and their urgent problems. This aspect has been overlooked while much emphasis is given to vigorous administrative measures as a means of increasing production. But whether this is feasible is a matter which needs serious consideration in the light of past experience.

After the introduction of the Montague-Chelmsford reforms, Fisheries became a transferred subject and the freedom of action thus conferred should normally have stimulated progress and expansion, but unfortunately in the case of fisheries either it failed to attract any notice altogether or assumed a false orientation through lack of appreciation of its scope and potentialities. Fisheries Departments have existed in some of the Provinces and States under the direction and control of officers trained in one or other of the Marine Biological Laboratories in Great Britain, who in conformity with their training looked upon Biological investigations as the most fundamental item of work connected with the development of Fisheries. Identification of fish, fish larvae and other marine organisms, were the main problems which attracted their interest and the younger generations which came under their influence imbibed the same principle until at last fishery investigation became a synonym for biological research of a superficial type. At the same time the provincial executives, with an eye on revenue guided the activities of the Department more and more towards that objective. Thus Fisheries Departments were generally looked upon as agencies for increasing revenue either through direct taxation or establishment of subsidiary industries. In other words the predominent tendency was to concentrate on revenue and eschew all schemes involving increased expenditure. Direct income was the criterion for estimating success, but in this the Fisheries departments fell short of expectations and so they were, by degrees, relegated to positions of minor importance or allowed to exist under sufferance evoking little or no public interest.

Such was the position of the Indian Fisheries till the beginning of the present decade. Efforts to improve the industry were characterised by complete absence of any definite constructive programme of work for the scientific exploration of the marine resources or for improving the condition of the fish trade in general. Sporadic attempts were made from time to time to introduce trawling or other type of large scale fishing practiced in North Atlantic regions or in Jupan. But since these experiments were not based on scientific data they were foredoomed to failure and proved nothing more than the futility and absolute wastefulness of blind imitation of foreign methods on the random suggestions of foreign experts who had no knowledge of Indian Fisheries. The achievements of an industrial department like fisheries are to be Judged not merely by the number of new fishes which they have christened or the number and bulk of reports produced but by the extent of their usefulness to the industry in terms of new ideas or suggestions calculated to promote efficiency and expand scope and possibilities. There is no doubt that India has spent so far a few crores of rupees on the upkeep and maintenance of fisheries departments and the publication of reports and scientific papers on fisheries, which none but the experts themselves understand; but when this huge expenditure and the enormous efforts spent in the production of these reports and scientific papers are weighed against the practical results achieved, it is seen that the latter are almost negligible, as was proved recently when India found herself suddenly faced with the serious problem of food shortage. Desperate efforts were made to increase the production of every type of food material and naturally the vast resources of the sea attracted attention, but the fisheries departments were helpless; not a fish more could they catch from the sea or even distribute the available quantities to the best advantage. This background has to be borne in mind when contemplating any plan for the future development of our fisheries.

Marine Fisheries and Research.

Fishing is an industry which is as old as history of man; and in Europe it had reached a very advanced stage of development before the need for fishery research was first conceived at the International Fishery Exhibition of 1883. Following this, the Fishery Board of Scotland started the St. Andrews Marine Laboratory in 1884 and the Marine Biological Association opened a Laboratory at Plymouth in 1888. Both these laboratories, and many others which came into existence subsequently have contributed greatly to our knowledge of the seas, the life histories of fishes and other organisms found in the sea. Some of these laboratories are pioneers in the world of Marine Biology "and there is nothing of sea learning that they do not know there and understand rather better than other people do." Still they do not include within their sphere of activities any scheme of commercial fishery investigations or explorations of the sea with a view to discover new fishing grounds or new and improved methods of fishing This does not however overlook the fact that there have been many expeditions led by such eminent naturalists as Forbes, Goodsir, Darwin, Hooker, Huxley, Wylie Thomson, Agassiz and Michael Sars and his son, but all these expeditions were purely scientific in their objective and had nothing to do with fisheries. The reports, periodicals and books published by these organisations and expeditions are no doubt valuable scientific documents, indispensable as books of reference in any scientific institution, where work of similar type is contemplated or carried out, but not so indispensable to the fishing industry. Meanwhile the industry was growing mainly through the initiative of the industrialists and the fishermen.

During the early days of fishery research, Marine Biological investigations were regarded as the only essential item but in due course the greater importance of other technical problems such as preservation, handling, processing, distribution etc., was realised and this resulted in the creation of technical laboratories. Thus for example in the United States there is a splendidly equipped fisheries products laboratory of the Fisheries Bureau at Washington and another worked in association with the Sea Fish Commission at San Pedro. There is the laboratory of the College of Fisheries, Seattle, and the Fish Products Fellow-ship at the Mellon Institute of Industria Research in the University of Pittsburg. For many years a highly efficient research laboratory for the promotion of Nowegian fisheries has existed at Bergen in connection with the Fisheries Department. At this institute many important researches have been conducted on the composition of fish and fish oils, the composition and curing properties of salt of different kinds, the artificial drying of fish and kindred subjects. Similar researches have also been conducted by the Fishery Institute of Tokyo and its subsidiary establishments and the great development of some of the fishing industries such as the canning of salmon, the canning of crab, the drying of fish etc., may be traced to the functions of this Institute. More recently in Canada the Biological Board has been replaced by the Federal Fisheries Research Board created by Act of Parliament in 1937 and the programme of this Board includes increased emphasis on studies and experiments in connection with improved methods of handling and processing of fish.

If we carefully study the programme of work of all these fishery stations and technological institutes, it will be seen that their main objective is to give information regarding technical problems to those engaged in the industry. Thus we find these institutions giving opinions regarding the size of mesh of fishing nets, the size of fish to be caught, closed seasons etc., and also instructing the commercial man regarding methods of handling, preservation, processing etc. This shows that the necessity for such technical guidance presupposes the existence of an already established fishing industry, which can benefit by such scientific and technical investigations. In other words scientific investigations can only follow the growth and development of the fishing industry and not precede them as contemplated in the Chairman's report. This fact can be well illustrated by the growth and development of the British Fisheries.

In 1883 the fishing fleet of Great Britain consisted of 225 steamers, 8,058 first class sailing boats, and 17,364 second class boats This large fleet landed altogether 5,80,000 tons of fish valued at approximately £ 6, 076,000. By 1913 new and larger types of fishing vessels had taken the place of the old sailing smacks and the fishing fleet consisted of 1,675 steam trawlers, 884 steam liners and drifters, 205 and 1,960 second and third class steamers, 1,692 first class sailing vessels, and 8 948 smaller types of sailing boats. The more powerful boats which replaced the older types of small boats, enabled the fishermen to extend the scope of their activities from the Arctic Circle to the Tropics and the total catches landed at the British ports was 1,232,837 tons valued at £ 14,629,342. Thus it will be seen that during a period of 30 years the quantity of fish landed was more than doubled and there is no doubt that this increase in production was mainly due to the efforts of the businessmen and the capitalists who were responsible for the construction of bigger and more powerful boats which enabled the fishermen to extend the area of their operation very considerably.

These details have been discussed at some length only to show that increase in the production of fish is not a biological problem, which can be solved in a laboratory or from an arm-chair, by studying ecology, life history or habits of fish. It is essentially part of an industrial programme involving considerations of finance, organisation, commercial possibilities, landing and transport facilities and allied problems, all of which are beyond the scope and conception of research workers.

This suggestion does not however ignore the need for scientific investigations and research. Even now there are many problems connected with fishing, which call for immediate investigations, while further expansion under organised methods will no doubt create in the near future more problems, embracing a number of branches of Science. Methods of preservation, processing, utilization of waste products, preparation of fish oils etc., come within the scope of Chemistry, while the Physicist will have to tackle refrigeration, insulation, thermal radiation and such other mechanical problems. The Bacteriologist, the Botanist, the Engineer and the Zoologists will also have their share of problems to solve. But this does not imply that a Central Research organisation and a number of substations are essential. Though fishery researches are being carried on in many countries, in institutions exclusively intended for that purpose, of late the tendency has been to assign such work to University bodies, which are better equipped and more competent to undertake such investigations. Thus for example there is the Fish Products Fellowship at the Mellon Institute of Industrial Research of the University of Pittsburg the laboratory of the College of Fisheries, Seattle and the Marine Biological Laboratory of Liverpool University. But the most recent development in this direction was the establishment, in 1945, of the Pacific Coast Fish Cultural Investigation, with its headquarters at the Oregon State College, Cornvallis, Oregon, where officers and laboratory facilities have been provided under a co-operative agreement between the College and the Fish and Wild Life Service Section, to conduct investigations on all aspects of the cultivation of fresh water and sea run migratory fishes in the Western part of the United States, and to train students for fish cultural work, under the direction of Dr. Ira Gabrielson. This programme is in accordance with the views of many fishery experts who have maintained "that a body of investigators working together under the control of a University is more likely to produce results of value than a number of isolated individuals working with inadequate funds" (Jenkins 1935). But fisheries departments in India have not so far recognised the value of co-operation with University bodies for solving their technolgical and biological problems, nor appreciated the advantages of coordination with neighbouring political units for solving common problems. India is divided into a number of autonomous Provinces and States but so far as fisheries are concerned political barriers have no significance. Some of the Fisheries problems are regional while others are of general interest to the whole country. Each region may cover two or three political units and so he results obtained at one research centre may be useful to the adjoining territories also. It is therefore only natural to inquire whether all these common problems are to be worked out independently by each political unit, thus causing unnecessary duplication of staff and equipment or whether such unjustifiable waste of public funds should be avoided by introducing a system of regional co-ordination. The scheme adopted by the United States as part of their post war programme and which is cited above, is, I feel, an appropriate answer to this question.

We have in India a number of maritime Provinces and States with University Head-quarters in coastal towns. Most of these Universities have well equipped laboratories, library facilities and a staff of experienced scientists Each of these Universities may be made regional centres for fisheries research and the additional staff and funds necessary may be provided out of grants from Central and Provincial Governments and endowments and subsidies from large fishing companies, which may be started in the near future. Already there is a well equipped Marine Biological Laboratory at Trivandrum and Madras; and the Royal Institute of Science, Bombay, has been interested in Marine Biological problems for some time, while the Calcutta University has been working a scheme of fresh water fisheries investigation for a number of years. If the scope of these University laboratories is expanded by increasing the staff of research workers and by providing more funds, all the work that is contemplated as part of the post-war development programme can be successfully carried out without incurring the enormous expenditure involved in the creation of an independent Central Fishery Institution and its subsidiary establishment. The research activities of the various Universities may be guided, controlled and financed by a co-ordinating body, which may be called the Central Fishery Board of India, constituted of Representatives of the Universities, Administrative Officers, Trade organisations, Transport Officers, and Directors of Fishing Companies, if any. This Board may examine the progress reports relating to problems under investigation, assign new problems, provide the nenessary funds and endeavour to build up a closer co-operation between the commercial man, administrative officers, scientists and technicians.

Sea Fisheries of India

Though the vast extent of the oceans exceed the total area of land masses it is noteworthy that all the great fisheries of the world are confined to a comparatively narrow belt along the shelves and slopes of their continents. Even in this limited area the grounds or banks on which fish are plentiful occupy only a small fraction Beyond this area are the great depths which from the stand point of commercial fisheries are almost barren and it has been proved beyond doubt that this barrenness is not due to the difficulty of fishing at great depths but to the paucity of commercial varieties of fish. The list of species of fish which people the ocean beds is indeed long, but they are mostly rare and uncommon forms, which do not come within the category of food fishes and so there is no reason to hope that any great fishery will develop beyond the limits of the contininental slopes marked by the 200 fathom line. At this depth the continental shelf deepens very rapidly to 500 or 1000 fathoms. For practical purposes therefore the 100 fathoms or the 200 metre line may be taken as the limit for commercial fishing, though no doubt certain varieties of fish may be found in paying quantities down to 200 fathoms. This implies that in any scheme for determining the scope of fisheries in any country the first aspect to be considered is the extent of the continental shelf and the varieties of fish found therein.

A glance at the physical map of India will show that the continental shelf of India marked by the 100 fathom line is a very narrow strip running almost parallel to the coast line. Along the east coast it runs very close to the shore and seldom exceeds 25 miles in width, except at the Apex of the Bay, between the mouth of the Mahanadi and Akyab on the Burma coast. On the West Coast, between Cape Comorin and Karachi the continental shelf is comparatively widest region is found between Karachi and Ratnagiri, on the Malyan coast, with a maximum width of nearly 200 miles, in the region North of Bombay. There are also patches of shallow areas within the 100 fathom line surrounding the small islands and atolls off the Malabar coast, collectively known as the Maladive and Laccadive groups.

The total area of this continental shelf is approximately 1,50,000 sq. miles and of this it may be safely estimaied that not more thae 15,000 sq. miles is exploited at persent, yielding approximately 400,000 tons of fish. This means that if the remaining nine tenths of the total fishable water is also exploited on organised commercial scale it may be possible at least to double our fish supplies within a period, the shortness of which will depend on the determination and enthusiasm with which we approach tne problem and the practicability of the programme adopted

The Chairman recommends a pilot scheme of deep sea fishing invesigation financed exclusively by the Government, to discover and demonstrate the scope of deep sea fishing and to determine the best types of crafts and gear, which will be suitable to our conditions. But when we study the growth and development of the deep sea fishing industry in any part of the world it will be seen that the initiative has always rested with organised fishing concerns and their staff of daring seamen, fishermen and practical. When the waters nearer home become less productive or too crowded with smaller types of fishing boats, the larger boats venture further and further out into the sea in search of fresh grounds. In this way the British fishermen have extended their activities from the Arcti region to the coast of Morocco and before the war the Japanese fishermen have even wandered to the coast of the Andamans in search of good fishing grounds. This form of exploration with a definite objective inspired by a desire to discharge their responsibility to the share holders and ensure their own income and the security of their jobs, is more conducive to success than random investigations conducted by Governments, with limited funds and no responsibility. Biological investigations for estimating the fishery resources, for discovering and charting important fishing grounds and for preparing plans for developments based on accurate knowledge of life history, migration and distribution of fish may take many years and still may not lead to positive conclusions. But in the meanwhile, if given proper facilities, the fishermen will do their :job thoroughly and efficiently and bring ashore more fish for the hungry millions, aided, if necessary, by a reconnoitering aeroplane for locating shoal fishes on the surface of the seas or an "Anglers' Radar" equipment which not only can chart the ocean beds but also precisely locate bottom fishes.

Radar is the latest of the wartime discoveries to be adopted for peace time uses and the "Anglers' Radar" has been sucessfully demonstrated on fishing vessels in the Long Island sound. If the importance of these technological discoveries and the principles of industrial organisation followed in other countries, is accepted as the basis of our post war plans, it implies that steps to develop our fishing industry should include:-

1. Financial aid and technical assistance by Government for the formation of fishing companies with the ultimate object of building up a large fleet of fishing vessels.

2. Construction of small harbours in important fishing centres.
3. Provision of adequate docking facilities, landing quays, laying up berths and facilites for cleaning fishing vessels in all the important harbours.
4. Allotment of ground for curing sheds, and other shore establishments such as cold storages, ice factories and processing plants.
5. Provision of better facilities for road and rail transport.
6. Construction of good roads for connecting important fishing centres with rail heads or important consuming centres.
7. Researches on technological problems with a view to improve methods of preservation, processing and transport.

Commercial Consideration.

In our country fishing has so far been regarded as the meanest of professions relegated to the poorest of the poor and not deserving of financial support or public co-operations. This attitude and the general ignorance of the financial world regarding the scope and potentialities of the fish trade has been mainly responsible for the neglect of the fishing industry. This outlook has to be changed and in order to inspire confidence in the minds of the industrialists and financiers the Government must take an active interest in the formation of fishing companies, by contributing part of the capital required and by providing landing and transport facilities.

To the commercial man theoretical calculations of the total quantity of fish needed for the country, based on the minimum per capita requirement for a healthy diet is not a convincing argument for increasing production. The prime consideration to him before he invests his money is whether the fish he produces will find a good demand and yield a reasonable return for the capital invested and this has to be determined in relation to the cost of production, preservation and distribution and above all the purchasing power of the average man.

Fish has always been regarded as a cheap substitute for meat, but the word 'cheap' is relative to the purchasing power of the public. In countries like England and America, where the income of the average individual is fairly high, 6d. for a pound of herring or 1 sh. 6d. for a pound of frozen salmon from Canada may be comparatively cheap, but in India where the income of an average family does not exceed Rs. 100/- per annum, 4 annas for a pound of fish is really expensive and if the price is higher, fish becomes an exclusive commodity beyond the reach of average man. This is an important fact, which must not be overlooked by those who have been entrusted with the task of promoting fishery schemes in various parts of India, with the immediate object of increasing food supplies. There is no doubt that fish supplies can be increased and that frozen fish can be transported over land in suitable containers to the inland towns and villages, but if all this is planned without due advertence to the cost of production, preservation and transport it is no more the poor man's food but the rich man's luxury.

SUMMARY OF DEVELOPMENTS

As this Report had been prepared by the Chairman of the Sub-Committee in 1946, and as the National Planning Committee has not met in full sessions thereafter, no Resolutions have been passed by that Body on this Report.

No important changes, not noted in the Report and the Note attached, usually mentioned in the Summary of Developments, as in the case of other Reports, have taken place in this case.

K. T. Shah

REPORT

OF THE

SUB-COMMITTEE ON HORTICULTURE

PERSONNEL

Chairman

Dr. G. S. Cheema, Poona,

Secretary

Mr. Jabir A. Ali, Devnar Farm, Chembur,
Bombay

Members

Dr. P. K. Sen, Sabour, Bihar.
Shri. J. N. Rakshit, Gazipur, U. P.
Shri. Ratanchand Hirachand, Bombay.
Shri. N. Y. Kashalker, Bombay.

Mr. A. M. Mustaffa from Quetta was also appointed a member but he found it inconvenient to work as he was very far away. Further, Shri R. S. Dubhashi of Poona was co-opted right from the beginning of the work and Sardar Sahib Lal Singh of Lyallpur from January 1940.

INTRODUCTION.

This Sub-Committee was appointed by the National Planning Committee and given the following Terms of Reference :—

(a) market gardening, cultivation of vegetables, fruits, and flowers;

(b) methods of fruit preservation (canning, making of pickles etc. refrigerated gas storage of fruits and vegetables);

(c) other subsidiary industries, e. g. essential oils, scents attars etc. and any other questions connected therewith.

(d) Medicinal herbs, their cultivation and provement. Item (d) was added subsequently.·

As has been observed in the Introduction to Animal Husbandry and Dairying, the ordinary diet of India suffers materially for lack of a proper balance in the nutritive elements The proportion of protein, fats minerals, vitamins etc. in the ordinary diet is highly deficient. No doubt the intense poverty of the people and their exceedingly low income is responsible. for the poor nutritive value of their daily dietary.

Besides increased consumption of Milk and Milk products to remedy this deficiency there is needed an increase in the consumption of fruits and vegetables to supply the necessary supplement of minerals and vitamins. It has been estimated in the *Memorandum on the Development of Agriculture and Animal Husbandry* in India, issued by the Advisory Board of the Imperial Council of Agricultural Research, that the present production of fruits and vegetables in the country will have to be increased by some 50% to 100% at least, before an optimum diet can be secured for the average citizen in this country. Our present production of fruits is estimated by the same authority at some 6 million tons a year, and of vegetables at some 9 million tons. To assure an adequate normal diet to the citizen, both these would need to be increased by fifty and a hundred percent respectively.

The best way to provide this addition or supplement to the average diet is to grow more fruits and vegetables. In more than one place we have observed that there is considerable cultural land now lying fallow, or not brought under the plough for a variety of reasons, in the country,—over 150 million acres. This land can well be utilised to add materially to the production of fruits and vegetables, as well as to provide pasturage and grain and industrial raw materials. These lands, moreover, are in all latitudes and at all levels. so that terracing of mountain sides may help in the raising of nutritive vegetables. The growth of large towns in recent years provides an excellent market for such gardening; and so the suggestion is not wholly imaginary. The deficit in regard to fruits is very considerable, though not so great as in regard to pasture land or milk production, poultry, and the like. An earnest effort would, therefore, have to be made to add substantially to the area available for such cultivation.

While recognising the need for additional land to be brought under the plough, we should not overlook the possibility of improving the methods and implements of cultivation now in vogue in the area actually devoted to fruit cultivation and vegetable growing. In this matter, however, the attainment of national self-sufficiency is by no means difficult; and that, too, on a fairly decent standard of living.

The minimum requirement laid down as the objective form for nutritive food in regard to proteins, carbohydrates, fats, minerals and vitamins is a calorific value of 2400 to 2800 units per adult worker. This is lower than the standard prescribed (3600 calories) for the adult worker by the League of Nations; but perhaps reasons of climate may allow a reduction in this regard without material detriment to the health and vitality of our people. The contribution of fruits and vegetables in making up a proper dietary lies in their protective character by supplying vitamins and minerals. At the present time the area devoted to fruits and vegetables is something like 2. 3% of the total area under crops, while per head it works out at something like 0.014 acres, which is very low if we compare it to 1 acre of garden for every seven persons in Palestine, and one acre for every three persons in California.

It has estimated that the total production of fruits and vegetables in the whole of British India averages about 410,000, 000,00 lbs. while the total requirements of a well balanced ration on the basis of 2600 calories per adult worker, would work out at 270 lbs. per head per annum. This would mean a total demand for 756,000,000,00 lbs. On this basis we shall need to double the area under fruits and vegetables, and make such improvement in the methods of cultivation and growing, of these articles as would make up the deficit. It must also be remembered that such demand does not remain stationary. In proportion as the standard of living improves, the average income grows, and the demand will grow; so that the limit for expansion will remain ever elastic. There is a considerable amount of foreign trade in regard to fruits, which can easily be increased. If, however, we desire our own production of fruits and vegetables to benefit our own average dietary, we must see to it that these are consumed as much in the country as possible. The total value of the annual imports of fresh and preserved fruits, and their products, aggregates over Rs. 3 crores; but the exports are much smaller. The bulk of the imports, however, are in the form of canned fruit. With the development of methods of long-time preservation of fresh fruit and vegetables, and with the aid in long-distance transport of cold storage in ship-holds, fresh fruits and vegetables from countries so far away as Australia or Europe, are invading the Indian Market in increasing quantities. If the Indian Fruit-Grower is to be properly protected, and his industry encouraged both in regard to fresh fruit and canned, the tariff policy would have to be radically revised. Protective duties may have to be imposed on foreign imports to ensure at least the local market for the benefit of the local producer. The need of the factory worker in towns and cities for cheap food, and, therefore, duty-free imports of all food-stuffs, may cause some difficulty in revising the tariff policy on the lines suggested. But in view of the policy of national self-sufficiency, and the potentiality of the country, the sacrifice would be well worth making.

The people must also be made more conscious of the need of fruits and vegetables in the normal diet; and so a campaign of "Eat More Fruit" would also be well within the scope of active planning in this field. For this purpose and to inculcate a better understanding of the importance of fruit and vegetable in the normal dietary, as well as to develop improved technique of fruit and vegetable-growing, and of the canning industry of all kinds based thereon, the study of Horticulture on modern scientific lines requires very much to be encouraged. A special Department of Horticulture in the Agricultural Colleges must be added where it does not exist; and the necessary equipment in the shape of Demonstration Farms, gardens or orchards must be provided at the same time. Further research in fruit-cultivatiom, their diseases and handicaps, as also their proper grafting so as to improve the weight and quality of each, should occupy no small part in the curriculum of these Colleges and Departments. The information or the results obtained by research on these heads must be widely spread, so that the actual cultivator may be better familiar with the scientific technique relating to his industry.

Making of pickles,-preserves from vegetables and fruits has been an ancient, time honoured domestic industry, in which every housewife who prides herself on her knowledge of Domestic Science has more than an elementary experience. Under modern conditions, however, the industry particularly of fruit preserves is rapidly growing out of the domestic stage; and becoming a matter of large scale mechanised production. Such a modern large-scale industry in the preservation of fruits and vegetables of all kinds must necessarily follow in the wake of expanded and improved cultivation. Improved methods of transport needed for all kinds of perishable goods will stimulate this industry for a much wider market and a larger range of production than a cottage industry could provide. Ordinarily, fruits and vegetables have their seasons, and if these are to be available all the year round, it will be necessary to encourage the canning industry for soups, jams, tinned fruits of all kinds, whether by canning, bottling, drying and salting, or by cold storage. The capital needed for this development would be relatively small; while of labour and raw materials there is no dearth Besides preservation of fruits and vegetables, and making jams, sherbets, soups, pickles, etc. out of these, other subsidiary industries may also be founded on these materials, such as making of essential oils, scents, attars. Here also India has an ancient tradition of excellence which would be highly stimulated if this industry is made an integral part of the Plan.

Sericulture is essentially part of the same enterprise. In several parts of the country it already occupies an important place and is the principal source of silk production where the artificial silk industry is scarcely yet in its beginning The extension of the Mulberry tree in suitable soils should, therefore, be made part of the Plan, so that a more flourishing silk industry can be built up in the country. Bee-keeping and making of honey has been included in the Reference to the Animal Husbandry and Dairying industry Sub-committee. But essentially that is also not a different subject. The cultivation of potatoes has received considerable stimulus of late till it has come to form an ever more important ingredient in the national dietary. The cultivation of the Soya Bean is relatively unknown yet in India; but its potentiality and possibilities in these days of food shortage in the country, should not be ignored.

Yet another aspect of vital national importance of the development of fruit growing and vegetables consists in the provision of Drugs and Medicines from this source. India has been rich from time immemorial in medicinal herbs; and considerable skill has been acquired by its people in making drugs from these. But as in other directions, so in this also, the need for improvement in technique and expansion in dimensions is unquestionable. More than one Drug Research Laboratory has already proved itself a commercial success; but the industry itself is still in its infancy. If we are to be nationally self-sufficient in this vital matter, we shall have to remould our Tariff system progressively to meet our own demand for drugs and medicines, vaccines and sera from our own indigenous production. The Sub-Committee have accordingly recommended a National Herb Growing Association to concentrate on the proper study of the science and technique relating to all the problems bearing upon these industries.

K. T. Shah

REPORT OF THE SUB—COMMITTEE ON HORTICULTURE

CHAPTER I

It is admitted on all hands that the per capita income of the grower and the average man in India is very low as compared with the income of those in other countries, with the result that the standard of living here is considerably low, and consequently the efficiency of an average Indian labourer is five to six times lower than that of the labourer in Western countries. As a result of the low per capita income and the consequential low standard of living, the nutritional standard is very low. With a view, therefore,

(1) to improve the per capita income and

(2) to provide a suitable standard of living

the National Planning Committee have rightly included the subject of Horticulture within the province of their enquiry as one of the means to this end. In this connection the Royal Commission on Agriculture in India aptly said as far back as 1928 that, "all experience suggests that where favourable markets can be developed the substitution in whole or part of Horticultural crops for the existing field crops would materially advance the prosperity of the cultivator." In partial modification of this it can be said that the large percentage of area known as cultivable fallow, which is nearly 154 million acres, may with advantage, be brought under Horticulture, wherever conditions permit. Sir John Russell, reporting on the work of the Imperial Council of Agricultural Research in applying science to crop production in India, in 1937, has also said that " much more work should be done on the cultivation of green leafy vegetables, and demonstration of fruit and vegetable gardens should be set up, adjacent to the village, where they can receive water and manure ".

Scope of the Planning.

The scope of the planning as defined by the Terms of Reference, given in the Introduction, was clarified further to mean that the objective of planning should be to attain as far as possible.

(a) national self-sufficiency and,

(b) adequate standard of living for the masses.

The objective test that has been laid down, in so far as it concerns Horticulture, is as follows:

> "Improvement of nutrition from the standard of an irreducible minimum requirement of proteins, carbohydrates and minerals (as well as necessary protective foods) having a calorific value of 2400 to 2800 units per adult worker".

Diet Of The People.

Apart from the question of per capita income, the question of nutrition is all the more important. A time has indeed come when it is necessary to see that the population of India get enough to eat and are self-sufficient. Sir Robert McCarrison has shown, by analysing the diets of various communities in India, that they are, as a rule, very defective in quality and that growth and freedom from disease are directly co-related to the nature of diet. The diets of the people in the North are, as a rule, richer than those of the people in the South.

According to Dr. Aykroyd, whereas 3000 calories are the requirements per head in European and American countries, at least 2600 calories are required by an adult in India. He has drawn up on this basis an instructive table giving the ill-balanced ration, which is common in India and the well-balanced ration which is required for the maintainance of proper efficiency.

Items.	Ill-balanced ration.'	well-balanced ration.
Cereals.	20 oz.	15 oz.
Milk.	2 "	8 "
Pulses	1 "	3 "
Fats and Oils.	0.5"	2 "
Fruits	– –	2 "
Vegetables-leafy.	2 "	4 "
Non-leafy vegetables.	2 "	6 "

It must be mentioned, besides, that fruits and vegetables contain a large quantity of vitamins so necessary for the upkeep of proper health. It is, therefore, necessary in the first place to make the people of India nutrition-conscious, so that the physique and health of the people may be improved.

Foods are classified as protective and non-protective ; and it has been laid down by medical experts that a good diet should contain plenty of protective food, particularly fruits, vegetables and milk. The importance of the place of fruits and vegetables in the diet is being fully realised but remains yet to be given effect to.

Acreage Under Fruits and Vegetables.

According to the Royal Commission on Agriculture, the acreage under fruits and vegetables in British India is as follows:

1906-7 to 1910-11	3 m. acres,
1911-12 to 1915-16	6 ,,
1916-17 to 1920-21	5 ,,
1921-22 to 1925-26	5 ,,

And Sir John Russell gives the following figures of acreage :

1914-15 to 1918-19	5.70 m.acres,
1919-20 to 1922-24	5.42 ,,
1924-25 to 1928-29	5.00 ,,
1929-30 to 1933-34	4.82 ,,

It must be admitted that the figures of acreage are not properly maintained and well-classified in all the Provinces in India, but one thing is clear, that though in one Province there may have been some increase under fruits and vegetables there must have been some decrease in the other, with the result that there has not been any appreciable increase, on the whole, at least commensurate with the increase in population.

In fact, it is necessary to maintain a definite proportion of area under fruits and vegetables in order to supply the requirements of the people, but we find that it is very variable from Province to Province.

Province.	Percentage of area under fruits and vegetables to the total area.	Area under fruits & vegetables per head of population.
Bombay	0.63	0.009 acres
United Provinces	1.6	0.01
Punjab	0.95	0.001
Assam	6.1	0.05

The area under fruits and vegetables for the whole of India works out to 2.3% of the total area; and per head it comes to 0.014 acre, roughly.

A small country like Palestine has one acre of garden for every 7 men. California has one acre for every 3 men and about 250 acres of fruits garden for every 1000 acres of cultivated area.

Fruits and Vegetables Requirements.

Taking the average yield of all fruit and vegetable crops at 10,625 lbs. and 5,800 lbs. per acre, respectively, the total production of fruits and vegetables in British India comes to 410,000,000,00 lbs. The total requirements, according to the standard of a well-balanced ration, based on 2600 calories requirements @ 270 lbs. per head per year, would be 756,000,000,00 lbs. This means that the production is short of requirements by 45.8%, from the point of view of mere nutrition and self-sufficiency. If to this, the question of reasonable profiteering, for raising the per capita income is added, the whole problem of horticultural development would resolve itself into a question of increasing the area or the yield by 100% over the present position. An appreciable increase can be obtained by increasing the yield per acre. An attempt will be made in this report to outline the measures necessary for this achievement within the course of 10 years, as suggested by the Chairman of the National Planning Committee.

Difficulties in the Planning Work.

The work of planning is beset with many difficulties for the following reasons:

(1) The figures of acreage under different fruit, vegetable and flower crops for the various provinces are not available and are not classified for the different crops. It is, therefore, very difficult to assess the position with regard to the particular crops. The total acreage only helps us to know the general position. It is most essential that this branch of statistical information should be developed on uniform lines in all the provinces.

(2) The position of imports also is not known with regard to the various items. What we get is the total quantity of imports and its value giving some broad classification. It is quite necessary, for instance to classify between scents, synthetic and natural, essences and acids, fruit beverages, pure and synthetic, etc.

(3) Though market gardening is practised in some provinces, the economics of the same have not been worked out and in fact the importance of the improvement and development of market gardening is not yet fully realised.

(4) A few canning and fruit bye-product concerns have sprung up here and there, but the industry is still in its infancy. The ecnomics have not yet been worked out.

(5) Though Ayurveda is the proud heritage of India the economics of the cost of cultivation of medicinal plants is not known and the cultivation of these plants is not followed on scientific lines.

(6) The problem of storage and transport is not yet fully solved and thus, a great deal of the produce goes to waste, which it has not been possible to assess properly.

It was quite essential that the members of this Committee should have met oftener than they did, at least once every month, in order to discuss the horticultural position in the various provinces, but it was not possible due to financial and other difficulties. It was not possible for some members even to attend the few meetings that were held. We had only to depend on the information supplied by them in writing. Likewise, it was not possible to get replies to the questionnaire issued by this sub-committee from all the provinces, States, private bodies and individuals. The sub-committee, therefore, decided that one of its members may be requested to go round to the various horticultural tracts in India for collecting information, but even this was not feasible due to financial difficulties. In spite of all these difficulties, however, an effort has been made to get at the nearest truth and to plan out lines of development with a view to attainning the maximum development of Horticulture in all its aspects. In the past, various commissions and notable personalities have attempted to survey the position, but it is regretted that the work was not pursued with the required zeal for completeness. It is hoped that the present work will be pursued till the goal is achieved.

CHAPTER II.

General Considerations Affecting the Development of Horticultural Industry

Before proceeding to indicate the lines of planning in respect of the terms of reference, it would not be out of place to touch upon the general considerations that are responsible for the development of Horticultural industry in a very large measure. As related in the previous chapter, the most important objective is, no doubt, self-sufficiency of the country, but in order to increase the standard of living and the per capita income it is necessary to consider the problem from the point of view of internal and external trade.

Import and Export.

The figures of annual imports of fresh and preserved fruits and their products, by land and sea, in India reveals an alarming position. The following are some of these figures:—

1.	Fresh fruits, dried fruits etc. received via Khyber pass.	271156 maunds
2.	Fresh fruits received from Kandahar ...	453712 ,,
3.	Dried fruits and nuts received via Chaman	808002 ,,

The total quantity is thus 15,52,870 mds., valued approximately at 1½ to 2 crores of Rupees, according to the wholesale rates.

The Citric Acid, annually imported into Bombay alone, is as follows:—

From	*Quantity in Cwts.*	*Value.*
U. K.	243	Rs. 11,317
Germany	56	3,161
Belgium	10	591
Italy	500	26,650
Czechoslovakia	19	1,121
Other countries	712	41,318
	1540	Rs. 84,158

The value of imports of fresh, dried and preserved fruit and fruit products into India, by sea, is more than one crore of Rupees. So the total value of annual imports, by land and sea, amounts to more than 3 crores of rupees, which is indeed a very big figure.

If to this is added the value of imports of medicinal drugs and other fruit products, which it should be possible to manufacture in India, the total value of imports would be a very fat figure. The position of exports of these products from India is as follows:—

Fruits and vegetables, fresh	Rs. 60 lakhs.
" " " dried	148 "
	Rs. 208 Lakhs.

This shows that we are importing more than what we are exporting.

Import Duties and Export Transport Charges.

Considered from the point of view of import duties, it is apparent that the foreign goods are allowed to be imported into India at a considerably low duty, compared with the import duties charged by foreign countries on Indian goods. In order to encourage the external trade of horticultural products and produce, in fair competition, with foreign countries, it is suggested that the Indian Import Duties may be raised and brought to the level of the duties charged by foreign countries. If necessary, even a sur-tax of 15% by way of protection may be levied for the first few years. These measures coupled with the "Eat more Indian fruits and vegetables" propaganda will, it is confidently felt bring in more returns to the grower.

A careful study of the development of the fruit industry in Foreign countries shows that all fruit meant for export should be assembled at the port of shipment, where it can be conveniently and economically examined, stored, and certified in the best interests of all concerned. In regard to the storage facilities it is desirable to have cold storage facilities on the spot before the commodities are exported. Such a storage arrangement is quite necessary. It is also essential that the steamship companies running between Indian ports and European ports should be induced to offer cold storage space. This measure, particularly, is likely to prove a hall-mark in the opening up trade in fruits and vegetables between Indian and European countries. The export of mango, since 1932, has shown that if this facility is provided, India can build up a huge trade to the advantage of both India and European countries, because, on the one hand, fruits like the mango remain the monopoly of tropical countries, like India, and on the other hand, the mango, which has been found to be a very rich fruit is not yet available in sufficient quantities in Europe. It is likewise necessary that the British Steamship companies offer rates on a par with those offered to Australian growers, who are just like the Indian growers, as parts of the British Empire. The steamship companies, such as the P. & O. Co , should be prevailed upon to give such facilities. The Indian Railway and the coastal Steamship Companies will do well to lower the freight charges and speed up the transport, so as to take the produce to the port of import speedily. The apparent loss of freight to the transport agencies will be more than made up by the volume of business. These concessions will amount to the carrying out of the recommendations of the Empire Marketing Board. Further, the total of the charges on account of Port Trust and wharfage, customs and stamps, cart hire, coolie charges, shipping agency fees, steamer freight and expenses incurred at destination of delivery etc, per ton of fruit, comes to Rs. 130/-. These expenses added to the price of fruit increase the cost of fruit in England to the extent of 6d. per mango but the High Commissioner and the Empire Marketing Board desire that the retail price of a mango in England should not exceed 4d. each. This can very well be brought about by reducing some of the charges, to the advantage of the grower, the consumer, the transport agencies and the dealer.

Bombay and Madras grow a number of varieties of bananas and Dr. W. Burns Agricultural Commissioner with the Government of India, says that there seems, to be no reason why some of these really excellent Indian bananas should not find their way to the English Market provided the necessary sea transport was available. A control organisation should be set up to regulate the quantity and quality of the fruit and vegetables meant for export so that there may be no set back to the export trade once it is started. Care should, however be taken that export of only those commodities, which are in surplus is aimed at. It will be necessary to regulate this export so that local demands are met first.

Internal Markets

With regard to the internal trade, some of the present defects can be enumerated as follows :

(1) A large percentage of retail prices are taken by middlemen.

(2) A good proportion of the prices is absorbed in freight

(3) Only a nominal percentage goes into the pockets of growers.

(4) There is lack of uniformity in marketing.

(5) There is incompatibility in the wholesale and retail prices.

(6) There is a serious malpractice of effecting sales under cover.

To remedy these defects it is necessary to enact Regulated Fruit & Vegetable Market Acts in each of the Provinces on the line of the Regulated Cotton Market Act. Further it is also necessary to encourage the opening up of smaller fruit and vegetable markets in the mofussil towns with a view to cater to the demands of mofussil population and to bring about equitable distribution. Of course, there is an interchange of fruits and vegetables between one Prŏvince and the other, but within the Province itself there may be cities or towns big enough to consume a lot of the horticultural produce, which as present goes waste for want of market. These smaller markets would also be subject to the regulated Markets Act

Transport facilities help movement of internal trade a great deal. It is well known that, since the starting of Rajshala Calcutta Railway, mango gardens have developed all along the railway line. So also in Madras and Bombay the reduction of railway freights has encouraged the movement of trade to distant places like Delhi, Lahore and Calcutta. But in order to develop internal trade it is further necessary to have cold storage facilities at places like Delhi, Lahore, Amritsar, Karachi, Madras, Poona, Bombay, Calcutta and Allahabad. This would certainly bring in proper returns to the grower and encourage the much needed development of horticulture.

Horticultural Education

There are, at present, five Agricultural colleges in India, where horticultural training is imparted; but, in the opinion of this sub-committee, the subject is treated more or less as a minor one The subject of horticulture requires to be treated as a major one by the universities. Aptly has Sir John Russel said in his memorable report on the work of the Imperial Council of Agricultural Research that " the cultivation of fruits leads to the employment of far more labour than the cultivation of other crops and it is admirably suitable for the graduates of agricultural colleges. Horticulture is a specialised form of Agriculture and some special practices are a sine-qua-non to successful cultivation of fruit crops. What is required is a thorough grip of the various factors involved such as,

(a) the relation of soil and climate to fruit growing,

(b) the cultural operations and irrigation required,

(c) the manurial requirement of each individual crop,

(d) the control of pests and diseases,

(e) the preparation of produce for the market, preservation of surplus produce and starting of subsidiary industries and

(f) the organisation of storage, transport and marketing.

The syllabus, in so far as it relates to Horticulture, is drawn out merely on the lines of obsolete ideas, but it is not taught to perfection and from the point of view of Indian requirements, for want of time alloted to its teaching and adequate staff. It is, therefore, necessary that teaching, of horticulture in agricultural colleges should be properly organised and sufficient stress laid on the subject. Each agricultural college must have a set of experienced teachers, who specialise in the various branches of horticultural industry, rather than have one teacher to deal with all these subjects. Attempts at writing suitable text books should be encouraged.

In regard to the question of admission of students to the agricultural colleges, it is necessary to lay down a uniform standard for admission. We are of opinion that the students should be admitted to the agricultural colleges after Matriculation and that the degree course in Agriculture be spread out over 4 years, instead of 3, as in some colleges, so that it may be possible to devote more time to Horticulture which should include, broadly, the treatment of subjects, such as fruit crops, vegetables, flowers, ornamental and landscape gardening, preservation of fruits and vegetables, distillation of essential oils, sericulture, arboriculture and apiculture. The fourth year should be devoted to specialisation of any one subject, Horticulture being one of these. It is noticed that at present there are certain restrictions laid on students coming from outside provinces. This is highly undesirable and we recommend that far from making it difficult for outsiders to come, a college should have its doors open to people from within or without the province. This is likely to help the development of interprovincial trade in horticultural products and better mutual understanding of horticultural problems.

It is essential that the level of teaching of horticulture should be brought to a very high pitch so that it may be ordinarily considered unnecessary for Indian students to go abroad for such training. It may be quite necessary that such fully qualified agricultural graduates with a high knowledge of Indian horticultural conditions should go out to foreign countries to specialise in the general organisation of research, marketing and preservation cf fruits. In this connection Sir John Russell says that "with some notable exceptions the men who have gained most from postgraduate studies in Great Britain have, in my experience, been those who had previously held a post in one of the Indian institutions and who had done so well as to justify the privilege of study leave." In our opinion, therefore, it is time that our Universities are fully equipped, as in England, U. S. A., France, Germany and elsewhere so that the status of the degrees of Indian Universities be considered equal to those of foreign Universities. Unless the status of our agricultural degrees is raised, it is not possible to attract good students to the agricultural colleges. It is not possible for all good students to go to foreign countries for securing degrees. Further, it is also necessary that the primary and secondary schools should introduce the rudiments of horticulture and gardening in their syllabus in a general way."

Horticultural Research

With regard to research it is regrettable to note that the necessary importance is not still given to it. More often than not, the tendency is to take up a problem, but if a positive result is not attained in the course of a couple of years the research is dropped. Thus there is no continuity of work and little is it realised that research forms the foundation stone of all improvement. The Imperial Council of Agricultural Research and the provincial Governments have a few temporary Horticultural stations in India, where research work is carried on but it is still meagre and patchy, It is remarkable to note that the Provincial Governments should depend on the funds of the Imperial Council of Agricultural Research for starting even temporary sub-stations. In the opinion of this sub-committee it is necessary to have a chain of complete Horticultural experimental stations in each province, where the local problems in regard to fruit, vegetables, flower and preservation would be investigated in all their bearings and also foreign plants tested with a view to their introduction in India. It may be necessary to have a few sub-stations affiliated to such stations for tackling local problems and applying the results of investigations to local conditions. This may mean the appointment of specialists such as Horticulturist, Physiologist, Pathologist, Entomologist and Marketing Officer on such research stations in each province, to devote their whole-time attention to the development of Horticulture. The present stations may either be developed as, or affiliated to, the complete Horticultural experimental stations, as the case may be. At the Agricultural Institute of Delhi a fruit section may be developed to serve as a clearing house for information on all aspects of fruit industry and to guide and co-ordinate research. This section may also conduct economic surveys with a view to draw an accurate fruit map of India, showing the relative merits and demerits of each tract. Arrangements may be made at this Institute for a complete horticultural training course. This section will be responsible for advising the Government of India, whenever necessary, on matters of import, export, transport and marketing, that may require legislation in the interests of the development of Indian fruit industry. This section may also direct two main research stations, one in North India, in or around Delhi, and the other in South India, in order to cater to the two main representative horticultural tracts of India. This section should be organised in addition to the complete fruit experiment stations which will be run under the auspices of the Provincial Governments.

Horticultural Extension.

The results of all research have little value unless they are carried into effect. In fact, advisory work should closely follow research and the two together should be controlled by one and the same department. Propaganda should be intensified in some or all of the following ways:—

1. Holding short courses.
2. Holding regional fruit shows.

3. Arranging demonstrations and lectures, illustrated or otherwise, at meetings and fairs.
4. Issuing circulars and leaflets of Horticultural interest.
5. Organising market intelligence bureau.

Provincial Horticultural Boards may be established in each province with a view to carry out this work and to follow up the recommendations from year to year. The Punjab Fruit Development Board, the United Provinces Fruit Development Board, and the Fruit and Vegetable Market Committee of Bombay are instances of this type, but such Boards should come into being in every province.

Finance to Fruit Growers Through Co-operation.

Cultivation of fruits, vegetables and flowers falls under intensive type of Agriculture, and cheap finance is needed to meet the various requirements. The important items of such requirements are the purchase of special implements, fertilisers, insecticides and fungicides, improvement of land and, sinking of wells etc. The magnitude of such finance required is also big, as compared to that required for ordinary agriculture. Even in the disposal of produce finance is required for the purchase of suitable containers. The prevalent practice is to borrow money from the village money lender at exhorbitant rates of interest. Thus the farmer has to pay a good deal of his income, by way of interest and a very little portion of the profit is left for himself. It has been found in foreign countries, especially in Denmark, that finance can be raised by co-operative effort, and in India it has lately been suggested that multipurpose co-operative societies may be formed with a view to secure the required finance' and arrange for the purchase of agricultural requisites and disposal of produce. Fruit sale societies may be formed in every fruit-growing centre.

Fruit Growers' Associations.

In these days of keen competition and organised effort everywhere, it is essential that our fruit growers should organise themselves into associations. These associations should bring together all the fruit growers in a locality, try to understand their difficulties, get to know the results of research and disseminate useful information amongst the growers. These associations can also organise small credit societies and arrange sales on co-operative basis. The association will be the sign of an awakening amongst the growers because unless there is effort on the part of the growers themselves, all extraneous effort proves little useful. The Bombay Presidency Fruit Growers' Association and the South Gujarat Fruit Growers' Association in Bombay and the Fruit Growers Association, at Vizayanagaram and the Growers Association at Kodurin Madras, are instances, showing what organised effort on the part of fruit growers can achieve. Such associations should try to get better prices for the fruit growers and develop the fruit industry as a whole.

Main Recommendations.

(1) Import duties on imported fruits and vegetables may be enhanced so as to bring them in line with those charged by foreign countries for Indian produce.

(2) With a view to build up trade with foreign countries, cold storage facilities may be provided at the port of departure and on steamers and all charges may be lowered to the level of those in force in U. S. A. etc., so as to make it possible for Indian fruit to sell in Europe within reasonable price.

(3) Regulated market Acts may be promulgated and smaller markets developed for promoting internal trade.

(4) Horticulture may be treated as a major subject in Agricultural colleges and the college course spread over four years. The subject may be introduced in High Schools and primary schools in a general way.

(5) Complete fruit experimental stations may be started in each province, being supplemented by sub-stations to tackle regional problems.

(6) The Agricultural Institute at Delhi should have a Horticultural section, with a view to organise and develop research work of an all India nature in co-ordination with provincial workers by having two main stations in the North and the South.

(7) Fruit Growers' Associations may be started in all fruit and market gardening tracts and multipurpose societies established, in order to secure cheap finance.

(8) Provincial Horticultural Boards may be established in order to follow up research and intensify propaganda.

CHAPTER III

MARKET GARDENING & CULTIVATION OF FRUITS, VEGETABLES & FLOWERS

Market Gardening

First and foremost, it is necessary to point out, clearly. the difference between (1) market gardening and (2) cultivation of fruits, vegetables, and flowers as field crops in the ordinary sense of the terms. Market gardening includes the cultivation of fruits, vegetables and flowers, especially the vegetables, but is practised in the form of intensive cultivation for catering to definite local markets. This type of cultivation has been a great industry in several countries such as England. China, and France, which are noted for a high degree of specialisation. The market gardening is so popular in Western countries that an offshoot known as Allotment Gardening has of late developed wherein the aim is to produce horticultural commodities on particular allotments from the point of view of self-sufficiency or display of items at horticultural exhibitions. The market gardening and allotment gardening have been developed to such an extent in foreign countries that crops are grown in glass houses, greenhouses and hot houses with a view to modify certain unfavourable climatic conditions and present the crop to their town markets during particular seasons, and if feasible, as early as possible, so that there may be little of that particular crop in the market at the time. Production of vegetables in the off-season always pays well. In the ordinary cultivation of fruits, vegetables and flowers no attempt is made to speed up the growth or to provide artificial conditions for the crops, and as a result, the market gardening is certainly costlier than ordinary cultivation, but the margin of profit in the former is also very big.

Factors Necessary for Market Gardening

To encourage market gardening, therefore, it is but necessary that the market should be in the vicinity of industrial towns and cities, where people have ample money to spend, and where people know the importance of spending their money on fruits, vegetables and flowers, which are considered by ordinary public more or less as luxuries. Some of the few requisites, other than the existence of such a market, are the good roads for quick transport, cheap rail transport, the availability of sufficient manure and water, and last but not the least, the skill of the gardener.

Market Gardening in India

Coming to the practice of market gardening in India, of course, it does exist, though not in a specialised form, in areas round about towns in N. W. F. Province, the Punjab, U. P. and Bombay. The market gardens round about Poona supply the produce to Bombay. Bihar sends a large quantity of such produce grown along the Ganges to cities as far as Calcutta which is 400 miles away, because local markets are not available. Madras obtains its vegetables from Bangalore, Nilgiris and Kodaikanal. But it must be said that market gardening is not yet practised in India on a large scale (1) firstly because of the ignorance of the people about the dietetic value of vegetables and fruits, (2) secondly because of the absence of elaborate markets in the towns, (3) thirdly because of the scarcity of finance for such enterprise and (4) lastly for want of technical knowledge.

In India, which is a large country, it should be possible to organise markets in and around every big city and it is time that the Municipalities should take up this work. This will tend to the supply of proper food to the people and a proper return to the grower, thus encouraging proper distribution of wealth. In most of the minor towns and cities, it is not that the people do not require vegetables but that in the absence of their availability, according to the taste of particular markets, the demand remains dormant. This fact can be at once realised if we look to the instances of some cities where on account of the building up of markets, the sale of fruits and vegetables has grown up from year to year.

Scope for Market Gardening

Taking a few big citiess like Bombay, Calcutta and Madras, with a total population of 12, 14 and 10 lakhs respectively, it should be necessary to supply them with leafy and non-leafy vegetables as per well-balanced ration, to the aggregate of 750,000 lbs., 875,000 lbs., and 625,000 lbs. respectively per day. Mr. R. S. Dubhashi of Poona has worked out that under Deccan conditions, to produce 100 lbs. of vegetables per day, throughout the year, an area of 12 acres (6 acres in rotation) of medium friable loamy, well-drained soil is required. (Vide Agricultural College Poona, Magazine for December 1936). Thus, taking these cities only into consideration, the area under market gardens for vegetables, round about those cities should be nearly 96,000 acres, 117,000 acres and 75,000 acres respectively. Of course, figures of actual areas under market garden crops and also the records about the actual entry of vegetables into these markets are not available but it should not be considered hazardous to say that not even 50 per cent of required area is cultivated. Also kitchen gardening should be common everywhere. We, therefore, reiterate that it is not the demand for vegetables that is lacking in cities but it is the supply of the required sort of vegetables, according to the tastes of particular markets catered to, that is lacking.

Vegetable Cropping Schemes

The market gardener has to be trained up in the proper methods of grading and packing of vegetables, fruits, and flowers for the market and has to be supplied with concise, cut and dried schemes of vegetable cropping for various provinces and localities, giving doses of manures and treatment against pests and diseases, so that the gardener may not have to get discouraged by failures. Each province would do well to prepare such schemes and give wide publicity for general information. This done, the opinion of the Royal Commission on Agriculture in India that the "Prospects of market gardening in vegetables are more hopeful than those of fruit culture" will be realised.

Market Gardening Survey and Research

It is necessary that the Departments of Agriculture in all Provinces should make an economic survey of market gardening and carry out investigations on the important aspects, with special reference to the introduction of exotic and high-yielding varieties with a view to find out new and productive vegetables, which could be successfully grown under Indian conditions. The aspect of manuring, season of planting, proper seed rate and methods of protection from pests and diseases must also be included in the research programme. Some local varieties may also be improved by breeding. In fact, the problem of market gardening is so important, and yet so little is done that the problem deserves the immediate attention of Provincial Governments. Gardening survey will show that it is necessary to harness smaller rivers and provide irrigation and, wherever possible, work out the possibilities of using sewage water for cultivation of vegetables.

Use of Sewage for Vegetable Growing

In this connection it is interesting to note that China, Japan and Egypt are the countries noted for their use of sewage, specially for the cultivation of vegetables. At Giza in Egypt, there is a farm of 1000 acres under sewage. Sewage is a very rich source of Nitrogen, which is essential for vegetative growth, and a big city, with a population of a few lakhs should be able to provide enough sewage to a big area. It has been estimated that per head per year sewage valued at Rs. 2/- is available. This will show how valuable sewage is in the national economy, giving really wealth from waste. This would, apart from its right utilization, be commendable from the view point of sanitation. We would, therefore, recommend that along with the development of markets, small and large, in the vicinity of big cities, the Municipalities would do well to arrange for the conversion of animal refuse into sewage by activated sludge process and lead it out into market gardening areas by a chain of pipes. The Municipalities may recover the expenditure by charging small fees. It is also possible to get a large supply of farm yard manure and other slaughter house refuse from big cities like Bombay.

The Use of Electricity in Market Gardening

Investigations on the use of electricity in horticulture were undertaken in Europe and America, especially in Sweden in the last century but the work is still in its infancy. In India some work on these lines has been done by Dr. S. S. Nehru in Maihpuri, but we have yet to wait for the application of results to everyday practice. In this age of electricity, this would certainly be a useful line of investigation for the development of horticulture.

Floriculture

Except for a few fruits, probably fruit cultivation cannot come strictly under market gardening but floriculture does. The range of such areas will, however, be very near the markets, as it is not uncommon to see a taste for flowers developing in cities for diverse purposes. In this connection, it would be worth while for Provincial Governments to make selections from local wild varieties and to breed them, and further to encourage a taste for parks, landscape gardening and ornamental gardening by developing those that already exist and laying out new ones in suitable places.

Seed Stores

With the encouragement of market gardening, it is necessary to open up stores for supply of reliable seeds of vegetables and flowers. These stores should be inspected and certified by Government so that growers may get reliable seed. It is possible that every Province can run from 10 to 12 such stores located at important places.

(*b*) **Cultivation of fruits, vegetables, flowers on a field scale, away, from the local markets** :

It is difficult to draw a rigid line of demarcation, distinguishing market gardening from field crops. The field crops are mainly meant to feed distant markets in order to meet the deficiency of production, storage in the country and export. The requirements for these crops differ materially from those of market gardening in respect of the requirements of transport facilities. A medium type of soil with adequate water is the most important requirement of these crops. The crops that go under this category are the fruits like oranges, lemon, mango, pomegranate, guava, chiku, papaya, pineapples, grapes, figs. peaches, pears, apples and vegetables, like potato, onion, all root crops, chillies and sweet potato:

The Place of Fruit in the Diet

Cultivation of fruits is a problem of very great national importance. Fruits contain all the nourishing ingredients, such as vitamins, calcium and other salts, and are specially useful for the maintenance of vigorous health. The following table will give a comparative idea of the nutritive value of some of the grains, fruits and vegetables.

Table giving a comparative idea of *the nutritive value of some* of the grains, fruits and vegetables.

Name of commodity	Proteins %	Fat %	Starch %	Fibre %	Ash %	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin E	Calcium.	Iron	Phosphe-rous.
Rice	6.47	0.49	79.0	0.25	0.49	—	x	—	—	—	x	x	—
Wheat	17.62	1.8	65.13	1.30	1.65	—	xx	—	—	xx	x	x	xxx
Tur	21.12	1.6	65.8	1.10	3.30	—	—	—	—	—	—	x	xxx
Jowar	7.0	3.0	75.0	1.5	1.2	x	x	—	x	x	—	xx	xxx
Bajri	8.0	5.0	70.0	0.6	2.0	x	xx	—	x	x	—	x	—
Mango Ripe	0.15	0.77	18.2	—	—	xx	—	xxx	—	—	—	x	—
Papaya	0.5	—	3.5	—	—	xx	x	xxx	—	—	x	x	x
Orange	0.8	0.1	0.4	—	—	—	xx	xxx	—	—	xx	xx	xxx
Pine-apple	0.3	0.03	9.6	0.4	0.3	xx	x	xxx	—	—	—	xx	xx
Banana	0.1	0.1	7.9	—	—	x	x	x	x	xx	x	x	xx
Peas	23.7	2.0	40.2	22.0	12.0	xx	x	—	—	—	—	x	x
Potatoe	16.75	0.77	73.5	2.93	5.97	x	x	x	—	—	xx	x	x
Cabbage	19.5	3.0	61.3	8.8	7.2	—	—	—	—	—	x	x	xxx
Methi	46.0	4.3	56.1	11.5	11.3	xx	xx	xx	—	—	x	x	xx
Onion	11.52	2.17	78.5	4.0	3.6	xx	x	x	—	—	xx	xx	x

— Indicates either nil or not ascertained.

x Indicates the presence of good quantity.

xx Indicates presence of a very good quantity.

xxx Indicates the presence of rich contents.

It will be seen that although the cereals have got higher contents of proteins and starch the fruits and vegetables are rich in Vitamins and salts. In fact, the latter make up for lack of these vitamins in grains and have thus an indispensable place in the human diet.

The information is taken from various references. That is why doctors freely advise the use of fruits, during periods of illness. The place of fruit, however, in our general diet which is an ill-balanced diet, is practically nil, but according to Dr. Aykroid, every one must consume at least 2 oz. of fruit per day. That is to say we must have in India a supply of 40,000,000 lbs. per day. As already explained, the supply of fruits and vegetables need be increased by 100%, by increase of area or yield per acre, in order to supply this demand for domestic consumption and trade. Fruit being a not immediately perishable commodity, can be sent to long distances and if as suggested in a previous chapter, markets developed, there is sure to be a great incentive to the industry. It is rather surprising that in a country like ours, which affords suitable natural conditions for the cultivation of a variety of fruit trees, a lot of fruits and its products have got to be annually imported from foreign countries. In spite of the fact that fruit is still considered a luxury, the consumption of fruit is already more than production, because there is a considerable import of apples from U. S. A. and Japan and of grapes and oranges from U. S. A.

Scope for Fruit Growing

In connection with the well-balanced diet, both Dr. Aykroid and Sir Mccarrison have worked out that such a diet will cost about Rs. 5-/per adult per month, that for a child being slightly less. Leaving 10% of the population, as the rich class who can afford to spend more over this diet, the remaining 90 per cent of the population, who belong to or depend on the agricultural profession, should be able to raise their income, and in this effort, the cultivation of fruits provides ample scope for the utilization of man-power. As Sir John Russell has rightly remarked, "The cultivation of fruits leads to the employment of far more labour than the cultivation of other crops". Ordinary agricultural crops are seasonal, whereas fruit crops extend over long periods. Citrus plantation, for example, lasts for 20 to 25 years and grape vine plantations for 30 to 40 years, if well-planned out and cared

Province	Region	Fruits to be Supecialised	Fruit industries possible
	West coast.	Banana, pine-apple, sapotas, jack fruit, papayas, & early bearing mangoes, loose jacket oranges in Wynaad tract.	A factory for pine-apple canning and banana meal, figs & jam, papain, canned mangoes & candied jacks, papayas and mango pickles and chutney.
	Ceded Dists.	Sathgudi oranges, late and mid-season mangoes, for, grapes, figs, pomegranates papayas.	Canning factory for mangoes, and citrus beverages and also for candied and crystallised fruits of all kinds.
	Northern Circars.	Mid season and juicy mangoes, limes, Eadlapudi oranges, Batavian oranges, Sapetas, pine-apples, jack-fruit, papayas, loose jacket oranges in agency tracts.	Canning for mango, citrus, jack & mango beverages, marmalade candied and crystallised, fruit from mango, jack-fruit, pine-apple, mango pickles, chutney, sapetas jam, chickle and papain.

Fruit Research

Fruit is a very important item, both from the point of view of the diet of the people and the national wealth, and yet, very little has been done in the matter of investigating into the various problems that arise in daily practice. Till fruit research is undertaken on a more extended and intensive scale in each region, at the proposed complete horticultural experiment stations, and sub-stations, advisory work for extension of cultivation has necessarily to be of an empirical nature, based on the uncertain foundations of foreign experience, gathered mainly from foreign publications. More often than not, the foreign experience cannot be directly applied to our problems and fails to inspire confidence in the intelligent section of fruit growers. There are problems connected with the suitability of root-stocks, the shyness and periodicity in bearing, standardization of produce, breeding of high-yielding varieties and classification of horticultural crops, control of pests and diseases and last but not the least, the improvement in the quality of fruit. Our Indian fruit is generally inferior in quality and that is one of the main reasons why foreign fruits compete successfully with Indian fruit in the Indian Market. The research should be carried on persistently, till the problem is completely solved and if it is considered necessary to drop it in the middle there should be a committee to decide the issue. It is also necessary that all horticultural problems should be dealt with by fruit stations only and not by specialists in other branches so that the problem may receive full time and whole-hearted attention of the workers. In fact, research is the foundation on which depends the extension.

Introduction of New Fruit Trees

Any casual observer would notice that a large portion of hill side areas, along the coasts in Bombay and Madras has yet remained uncultivated. The areas can be profitably planted with cashewnut, especially for the roasting industry which will be described in the chapter under "preservation". Sir John Russell mentions that the oil obtained from the Red palm (Elacis guineensis) a West African tree, that could be apparently grown in India, proves a valuable source of Vitamin A, being as effective as codliver oil, but much cheaper. It is necessary to introduce such trees in suitable areas. Grape fruit and Italian lemon are new fruit trees which are introduced with advantage, in provinces like Bombay and the Punjab.

"Mass Eradication of Pests & Diseases"

One of the overwhelming difficulties of the fruit grower is the attack of his crop by pests and diseases. The pests and diseases appear, at times, in such alarming proportions that the crop is either partly or wholly damaged and the pest and disease spreads to adjoining areas like wild fire. The grower has not enough means at his disposal, nor the required technical skill to fight against. Government should survey such pests and diseases and launch a mass campaign of spraying suitable insecticide or fungicide or adopt any other suitable treatment for a period of 2 to 3 years in that particular zone. Government may purchase the required outfits and after demonstrating the use for the first year, rent it out to the growers for the 2nd and 3rd years. This will ensure the complete control of pests and diseases at least for many years thereafter.

Vegetable Research

Potato seed is, at present, obtained every year from Italy and Cyprus, except in Madras, which gets its supply from the Nilgiris, but the work that is being done in stray places is indeed very meagre. It is of the utmost importance that we should select some places, where potato seed can be multiplied quite successfully and in sufficient quantities. There are some serious diseases which affect this crop and thorough research has to be done to stabilise the industry. Crops like Potato, onion and Suran can apart from meeting the local demands, be used for export, as they stand storage for export purposes. In 1937-38, 1.1 million Cwts, of onions, valued at Rs. 44.5 lakhs were exported. The area under these crops is also not correctly known but these crops are money crops and will help to raise the income per capita. Research in other vegetable crops, like the brinjal and chillies, termeric, ginger garlic should be undertaken.

Fruit Cropping Schemes

As we suggested in the case of vegetables, it is necessary, in the case of fruits also, to draw out a table, giving the information in respect of each crop regarding the soils suitable, and the other factors necessary for the successful cultivation. Further, it is essential to make a survey of pests and diseases and work out remedies, suggest manurial doses, with times of application, manures for the different crops, the amount of water required by each crop and the interval between two waterings, etc. Other information required by the fruit grower should be with regard to the storage, grading, packing and marketing. The subject of containers for marketing is very important and may afford scope for village industry. The calamities such as incidence of damage, by frost, should be met by suitable measures, as otherwise it brings in great disappointment to the grower. In Nasik (Bombay Province) the frost hazard works an alarming damage to the grape vine crop and the economics of measures such as burning of ordinary fires or oil heaters should be worked out. In fact, the knowledge about the technique of cultivation of fruits on a large scale in all its bearings, the protection of crops from risks attending frost and pests and diseases and the marketing should be made available to the rural areas and then it should not be difficult to expect an extension of areas under fruit or increase of yield, within the course of 10 years. The process should be on well founded lines. The river beds, .nullas and roadsides should be utilised for growing fruit trees wherever possible.

Fruit Extension Schemes.

Mere propaganda and Government Demonstration Farms are not adequate for fruit extension Funds should be provided for fruit extension schemes. The funds should be found either from Taccavi grants without interest or from banks established by Government at a cheap rate of interest. In order that the money thus advanced may be recovered easily later, these schemes should be controlled and organised by a Development Board consisting of the Agricultural, Irrigation and Revenue Departments, for at least a period of 10 years but the owner of the land should be made to take active interest in its management. In fact the Taccavi loan should be deposited in a bank in his name, the money drawn as required and payment made through him. Any income that may accrue at the end of five years when the trees would start bearing should go to the owners after paying the capital cost and the running expenditure. In the case of owners who cannot afford to wait for 5 years an in-come usually derived from ordinary crops should be paid from some source such as growing of intercrops of cabbage, knolkol, tomatoes, brinjals, bhendi, chillies etc. regularly. Such schemes will pave an effective way towards cooperative farming and cooperative marketing, as most of the operations will have to be done cooperatively. Such schemes will show in a striking manner what can be done in a specific period by the people themselves under effective technical guidance. The unit of such a scheme should be 25 to 100 acres.

The Malbzai Vineyard Scheme of 100 acres and Murtal Khurd Almond grove scheme of 50 acres in Baluchistan and a few such schemes in the Punjab may be quoted as examples.

Tree Planting.

Tree planting in villages should include growing of economic fruit trees such as Jambhul and Bor on hill side areas.

Arboriculture days are regularly observed in foreign countries in order to make mass efforts to cover up all barren areas with vegetation. Tree-planting gives many advantages, some of them being the supply of fuel, the modification of climate in hot districts, the prevention of soil erosion and the regularity of rain. As an item of the village improvement programme in the Bombay Province, an effort is bing made, recently, to grow some seedlings in such areas on particular days in the monsoon, but the programme should be more widely followed. Mysore has got a regular bold scheme in this direction. But before tree planting is taken up on a mass scale it is necessary to have a list of trees to be planted under different conditions of temperature, rainfall, soil suitable, and the purpose. Bombay Province has prepared such a list and has a scheme for raising the required number of seedlings in suitable centres. This should be done in other provinces also.

Nurseries.

In order to extend fruit cultivation it is necessary to have an arrangement for the supply of reliable grafts and plants in every province. Every province has, at present, a few such private nurseries and also nurseries at Government fruit stations. In order, however, to have standardised fruit of improved quality it is necessary to legalise the sale or distribution of only the best type of plants and grafts. At present there is a ruthless competition with the result that many times plants of doubtful quality are sold. The Agricultural department should supervise this work and the plants should be sold under its certificate. There should be nurseries at suitable places in every zone and all such nurseries must be registered.

Horticultural Policy of Government.

In spite of all research in horticulture and organisations like the fruit growers' associations, the actual extension of fruit cultivation depends to a very great extent on the policy adopted by Government in regard to horticulture. First and foremost, Government should arrange for a wide distribution of reliable plants and grafts, legislate favourably in regard to imports and exports, transport, marketing and supply of finance, hold regional exhibitions and above all give away fallow lands on easy terms to enterprising farmers and extend irrigation schemes. It is interesting to note that the Government of Baroda adopted part of these methods by granting the following concessions.

1. Waste land is given to prospective growers, without assessment for seven years, half assessment from seventh to fifteenth year, and full assessment thereafter.
2. A bounty of Rs. 20/- per bigha is granted on all newly raised plantations for a period of five years.
3. Fruit nurseries are developed and given away to growers' organisations.

4. No increase is made in assessment on Jirayat land converted into Bagayat planted with fruit trees for 20 years.
5. Long term Tagavi loans are granted at special concession rates for fruit growing.

Canal irrigation policy and charges on water should be adjusted to the requirements of fruits and vegetables so as to encourage the development of orchards in general, and market gardens in particular. The Irrigation department, at present, forms a part of the Public Works Department in most of the Provinces, but the Agricultural department is never consulted as regards the policy to be adopted in the matter of distribution of water, water rates etc. We, therefore, recommend that the existing rules and regulations of the Irrigation department and the water rates should be suitably modified in consultation with the department of Agriculture in the light of the policy discussed in this report.

Main Recommendations.

(1) Municipalities in big cities should organise markets for the produce of market gardening.

(2) Cut and dry schemes of vegetable cropping, giving doses of manures and treatment against pests and diseases, should be prepared for various provinces by localities near markets, and kitchen gardening should be encouraged.

(3) All provinces should make economic surveys of market gardening.

(4) Exotic ·and high yielding new varieties of vegetables should be introduced.

(5) Special research on different aspects of market gardening should de undertaken in each province.

(6) Smaller rivers should be harnessed and irrigation provided for cultivation of vegetables.

(7) Sewage water schemes from big market cities to the rural areas of market gardening should be taken up.

(8) Investigations into the use of electricity for market gardening may be carried on.

(9) Investigations in selection from wild flowers should be undertaken and a taste for flower gardening created, by developing parks etc.

(10) Stores for supply of seeds of vegetables and flowers should be opened in each province in suitable places and inspected and certified by Government.

(11) The educated youths and the retired men should be induced to colonise and do horticulture on collective basis.

(12) A survey of all horticultural tracts should be made and fruit areas should be marked out as "Zones for particular fruits".

(13) Tables should be prepared for each province, showing the conditions necessary for growing fruit crops, treatment against pests and diseases and manuring.

(14) Nallas, river beds and road sides should be planted with fruit trees, wherever possible.

(15) All-round research in fruits should be undertaken.

(16) Cashewnut should be planted on all areas along the coasts in Bombay Province and Madras.

(17) New trees, such as the Red palm, should be introduced in suitable areas.

(18) Smaller markets should be developed for distribution of fruit.

(19) Research work on potatoes, onions and other important vegetables should be undertaken.

(20) Tree planting should be intensified in all provinces.

(21) Nurseries for supply of genuine fruit trees should be started by Government Agricultural departments.

(22) Government should pursue a sympathetic policy for development of Horticulture and modify irrigation policy suitably.

(23) Mass eradication of pests and diseases should be undertaken.

(24) Fruit extension schemes should be encouraged by the grant of Tacavi loans.

CHAPTER IV

PRESERVATION OF FRUITS AND VEGETABLES

If we look to the history of preparation of morabbas and pickles in India, we find that the art of preservation in some form or other was known right from the time of the Aryan culture. In fact 40 to 50% of the waste of fruits and vegetables that takes place now should be considered a great crime, when we have not enough even for maintenance. It, however, happens that there is, at times, a glut of particular commodities in the market, in particular reasons and total want of them in the other. It is here, that the question of preservation becomes important.

Scope for Preservation Industry

Preservation can conserve lakhs of rupees worth of fruits and vegetables and make them available in all seasons and in all centres. During the period of glut, the price obtainable for these fruits go so low that the grower seldom gets the prices of even picking. This will be at once realised, if we look to the waste that results especially in the case of fruits like the guava and the bananas in all centres of production. Canning and preservation, therefore, is an industry of an all-India importance and it has got to be put on the basis of a really profitable industry. The manufacture of various bye-products from the surplus of fruits and vegetables will be the key to success of the horticultural industry. It is an industry that will give relief to the growers, reduce unemployment, both among the masses and the educated, if they properly understand the dignity of labour. In spite of the fact that such diverse and ample fruits grow in India and are available cheap we find that India imported nearly 43,287 cwts. of canned and bottled products, valued at Rs. 11,23,953 in 1935-36. The following statistics with regard to the import of canned and bottled products at the port of Bombay from countries like U. K., America, Australia, and Japan would be found interesting.

PRODUCTS	1933-37		1937-38	
	Cwts.	Rs.	Cwts.	Rs.
Canned & bottled fruits.	1,09,666	2,28,463	15,576	3,48,265
Others, including Juices	16,953	9,16,041	21,193	10,83,691
Jams and Jellies.	5,851	2,02,168	6,328	2,21,852
Pickles, Chutnies etc.	1,846	1,35,023	2,270	1,61,103

The remaining quantity is received at the ports of Karachi Madras and Calcutta.

The food value of fruits and vegetables does not lower much, except for vitamins after canning, as can be seen from the following table.

	Water	Protein	Fat.	Carbohydrates.	Fibre.	Ash.	Fuel Value per lb,
Pine Apple:							
Canned	61·8	0·4	0·7	36·4	–	0·7	715
Fresh	89.3	0.4	0·3	9.7	0.4	0.3	200
Tomatoes:							
Canned	94·0	1·2	0·2	4·0	0·5	0·6	155
Fresh	89·6	1·3	0·2	8·1	1·8	0·8	185

With the extension of fruit and vegetable cultivation, therefore, it is absolutely necessary to develop the preservation industry in order that the produce may not be allowed to go waste, whether due to lack of transport, or glut in the market. This is also necessary because our horticultural produce is generally inferior in quality.

Favourable and Unfavourable Factors

The factors that are in favour of starting this industry was that a variety of fruits is available and in large quantities, and that the labour is proportionately very cheap, but the points against the industry are that there is not yet enough taste for such products, there is lack of enough capital or if the capital exists it is shy, there is serious foreign competition, and last but not the least, there is lack of adequate research in connection with the preservation of all those fruits, except at a few places like Llyalpur, Kodur, Baroda and Poona. It is necessary to have a fruit and vegetable laboratory in every province in order to mark out all details in respect of commercial varieties of each region and help prospective businessmen in the technique. These laboratories should be attached to the Agricultural Colleges, wherever they exist. The Universities also may take to this research.

In the face of these handicaps it is gratifying to see that new factories have developed, lately, in India. The Madhu Canning Factory in Bombay, the Indian Fruit Canning Industries, Ltd., at Bezwada, The India Fruit Ltd., at Kadiam, in Madras, Glacier Fruit Products India, Pathankot, District Gurdaspur and the Ranala Factory in the Punjab, may be quoted as some of these. There is a good deal of scope for canning pine-apples in Assam. The establishment of such factories have, to a certain degree, served the intended purpose, viz. the preservation of fruit from waste, the employment of some unemployed hands, and above all the proper prices being obtainable by the grower. The preserved products can be popularised in Restaurants.

Forms of Preservation

The chief methods of preserving fruit so as to present wastage and season gluts are known to be (1) Canning and bottling (2) Drying and salting and (3) Cold Storage. Drying and salting are done, to a small extent, for home consumption, but preservation for commercial purposes is practically unknown in India. Most of the fruits and vegetables can be preserved in one form or the other.

The following are some of the forms in which the fruits and vegetables can be preserved:

Canning: Mango, Pine-apple, Apple, Peaches, Pears, Apricots, Litchies, Chiku, Peas, Tomato, Beans, Greengram.

Juices & Syrups: Lime, other citrus fruits, Pomegranate, Jambul, Phalsa, Karwanda and Tomato.

Jams, Jellies & Marmalades: Fig, Papaya, Guava Gooseberry, Strawberry, Blackberry.

Cheese: Guava.

Drying: Banana, Dates, Fig, Karwanda, Jack fruit, Kokum, Litchies, Pears, Potatoes.

Candying: Bor, Citrus, Peels, Plums.

Chutneys: Tomato, raw mangoes.

Pickling & Salting: Mangoes, Kokum, lime, Cauliflower, turnip.

Sauce: Tomato.

Vinegar: Grapes, Pears, Dates, Apple and Cashew.

Nuts: Cashew, Almond and Walnut.

The list of fruits and vegetables, which, can be preserved in one form or the other can be developed later as experience is gained but this list would show that most of the fruits are available in India and are likely to help the industrialist and the grower, alike.

Requirements of the Industry: The greatest difficulty in the actual launching of the Industry are lack of :—

(*a*) Research and technical guidance.
(*b*) Capital, and
(*c*) Containers.

It is estimated that a fair sized canning factory requires ten to fifteen lacs of rupees as capital, but at a conservative estimate Rs. five lacs should suffice fot a medium sized factory. In the opinion of fruit canning businessmen like Mr. N. Y. Kashalker, 10 canning factories in India should be considered adequate, without any fear of reaching the saturation point. It is, therefore, suggested that every year, henceforth, one canning factory may be started at a central place in each Province, raising the capital on share basis, if possible, with an assured capital from Government. If this is not possible, big industrial capitalists should be induced to start the business by a subsidy from Government at Rs. -/3/- per can, produced from the first few years and later on cans that will be exported only. This sort of a move is likely to attract industrialists to invest their capital in this most important and prospective industry. In the opinion of some experts in the line, there are conflicting views viz., (1) that a food industry like this does not lend itself to small cottage size and (2) that it is the most suitable one for being started as a cottage industry. We are of opinion that, in so far as the household or local demands are concerned, small industrial units of the multipurpose type may be started with a capital of eight to ten thousand rupees on co-operative basis, but where production is large and is meant for preservation, either for inter-provincial or inter-national trade, it should be in the hands of big industrialists. Only care will have to be taken that poor quality does not result as an outcome of ruthless competition.

The other formidable question is about the containers. Imported sanitary cans are very costly, with the result that the saleable price of canned products become high enough and cannot stand competition. If the cans be made in India, the price of the cans will be 40 to 50 per cent less. So, along with the establishment of canning factories, can-making factories may be started in each province. It would also be desirable to induce the glass factories, such as the Talegaon Glass Works and Ogale Glass Works, to prepare suitable sized bottles and jars for purposes of bottling juices, and jellies according to the demands. It is necessary to appoint food inspectors to examine the products before sale and see that no forbidden preservatives are used in the processes and also that proper attractive labels are put.

During the first few years, it may be necessary to request Governments to reduce duties on Sugar used for canning or making of syrups and to request the Railways to reduce their freight for canned produce. In this connection, it is possible for India to have a monopolistic trade in the export of canned mangoes and the Indian Trade Commissioners in England and America may be requested to do a bit of propaganda and to find out the prices at which cans may be received popularly in those countries. It is also necessary to make a propaganda for canned products in India, as at present, tinned foods are used only by the very rich.

Fruit Juice Industry

The greatest scope for the fruit and vegetable preservation, at present, lies in the development of fruit juice industry. India is a tropical country, where cold drinks are in constant demand, throughout the greater part of the year. This demand is, at present, being met by resort to aerated waters, which generally contain nothing but synthetic materials, like saceharine, essenses and colours, all of which have absolutely no food value. If these artificial areated waters can be substituted by pure fruit juices either by persuasion or propaganda, or by enacting laws, it would not only go a long way in raising the income of fruit growers and giving employment to hundreds of educated as well as illiterate people, but would also add to our national health and efficiency. Laws should be enacted to debar shopkeepers from selling beverages, not conforming to the standards laid down.

The Cashewnut Industry

With regard to cashewnut, which may be truely called the poor man's almond, it is a fruit that lends itself to great development for consumption, both in India and abroad. Cashewnut is a very popular fruit in the confectionary trade of Europe and America. The cashewnut is abundant in the low regions of the Goa territory, in places like Ratnagiri, and Kanara, Guntur, Godavari, Vizagapatam, Malabar, Cochin, Travancore, in fact all along the West Coast. It is a fruit tree that is not fastidious in regard to its requirements of soil, and can be grown all over the hillside areas, lying fallow near the coasts. It stands drought to a great extent.

The cashewnut tree lends itself to several products such as (a) Kernels of nuts, (b) Liquor and (c) oil of the pericarp. It is the first that is the most important. There is an expert class of people in the Cashew growing regions who do the roasting and other operations remarkably well. But the technique of roasting, shelling and packing must be thoroughly investigated and necessary improvements brought about to suit the requirements of foreign markets. Mechanisation of the various operations is essential for cheap production. A great deal of improvement in the existing machinery is also needed. The following figures will give an idea of the increasing scope for this industry:

Year	Presidency	Kernels exported outside India.	
		Tons	Rs.
1929-30	B. P. Madras	1940	21,19,472
1931-32	,,	3,392	44,89,493
1937-38	,,	13,000	1,29,00,000

But we are receiving a large quantity of cashewnuts from foreign countries, such as Kenya and East Africa to the extent of 3,562 tons valued at Rs. 5,00,425/- though we should be able to grow our own produce on the hillside lands. Foreign Governments are likely to have their own concerns in India with the result that the cashewnut trade may go out of Indian hands if prompt measures are not taken to stabilise it.

As a result of the increasing demand for cashewnut kernels in overseas market, it is satisfactory to note that Cochin Government have established the industry on a large scale and exported nearly 71,68,000 lbs. in 1936 to countries, such as U.S.A., U. K., France, Belgium, Australia, and New-Zealand.

Cashewnut factories are capable of absorbing a large per cent of rural population, as can be seen from 15,000 workers absorbed by the six factories in Mangalore alone.

Salting and drying of vegetables

Before we leave the question of preservation, it is necessary to mention, that in order to allow no waste in vegetables the salting and drying industry of vegetables should be enlarged all over the countryside as a hoem industry. It is essential to remember the wellknown adage 'waste not, want not' in this connection. If the surplus vegetables can be preserved for times of scarcity, it can remove the want in those times and the money spent over raising the crops will not go waste. This item, particularly, should be attended to by the newly-started Departments of Rural Development, which can do well to popularise these vegetables and organize the industry. They may chalk out the work, district by district, in such a way as to cover the whole ground in a period of ten years.

Cold Storage: The other methods of preservation of fruits are the cold storage and gas storage. These methods, however, are yet in an experimental stage. The results of the cold storage work done at Ganeshkhind Fruit Experimental Station are that Alphonso can be kept at 45° F to 48° F for 50 to 60 days and oranges at 40° F for 12 weeks. The experiments in the Punjab have shown that pears can be kept well at 32° F for five months, grape fruit at 36° F to 39° F for four and a half months, and Maltas at 36°F to 39°F for two and a half to four months, depending on the variety. A beginning has already been made by the export of Alphonso mangoes to England. With the opening of markets abroad, it is hoped that steam ship companies will provide cold storage facilities during transport. The results of these investigations will be of very great use for extending internal and external trade of Indian fruits.

So, it can be safely said in respect of all fruits that the 40 to 50 per cent of fruits and vegetables, which go waste almost in every province, for one reason or the other, may be canned or preserved, and the work of organizing these Industries may be covered in ten years' time. So also with regard to cashewnuts. These industries would bring more returns to the grower, increase the per capita income, be a medium for better distribution of fruit and wealth and finally improve the standard of living.

Main Recommendations

1. Laboratories for research in canning and preservation may be started in each province and attached to Agricultural colleges, wherever they exist.
2. The fruits and vegetables being diverse and cheap, and labour being ample, there is scope for starting small cottage concerns for local use, and big factories for inter-provincial and international trade in preserved fruits and vegetables.
3. Industrialists may be encouraged to start the Industry by subsidising.
4. Can-making factories may also be started, side by side.
5. Existing glass factories may be induced to manufacture bottles and jars.
6. Propaganda may be made in foreign countries through Indian Trade Commissioners in favour of Indian preserved fruits.
7. In order that the cashewnut trade may not go out of Indian hands, the Industry may be stabilized early.
8. Salting and drying of vegetables as a home industry, may be pushed forward.
9. The British Steamship Cos. may be induced to provide Cold Storage facilities for the transport of fruit to foreign countries.

CHAPTER V

SUBSIDIARY INDUSTRIES CONNECTED WITH HORTICULTURE

The Subsidiary industries other than preservation of fruits and vegetables are generally meant to cover up the spare time of cultivators; to provide work to those who are unemployed on the farm and make the most of lands that are unsuitable for the major crops. Such industries, so far as the main occupation of Horticulture is concerned, are the production of:—

(1) Essential oils, scents and attars.
(2) Gulkand.
(3) Honey and
(4) Silk.

These industries are of course in existence for a long time but they require a great deal of improvement.

Essential Oils, Scents & Attars: Essential oils, for all practical purposes, may be defined as odoriferous bodies of an oily nature obtained from plant life. The process of obtaining them may be by:—

(1) Expressing,
(2) Distillation or
(3) Extraction.

Natural perfumes are supposed to have a great beneficial effect on the nervous system. The industry was followed to a certain extent in U. P; but artificial perfumes are trying to beat the natural perfumes out of existence. It is, however, being realised that artificial perfumes have not a healthy effect on the human nervous system. Efforts are, therefore, being made to prepare natural scents at low cost so that they can successfully compete with the artificial scents. So far as is known to us, the only factories that are making some research in the line are Rakshit Perfumery and Essential Oils Laboratory at

Ghazipur, U. P. and the Government Kerala Soap Institute, Calicut. The demand for such perfumes is worth about Rs. 50 lacs per year in India. The following trees and plants of Horticultural importance yield the products:

1.	Fruit Trees	Citrus Trees specially Kagdi Lime	Essential oil.
2.	Other Trees	Tulsi Plants (Ocimum Sanctum). Cinnamon Trees. Sandalwood. Eucalyptus Trees.	
3.	Flowering Plants	Roses Tuberose Jasmine	Attars Perfumes.
4.	Grasses-	Lemon grass-Lemon grass oil Plam Rose from Rosha grass.	

Of the Citrus Trees, Kagdilime yields the much prized lemon oil from the peels of its fruits or from branches and leaves. After the fruit is used for juice, the peels yield essential oil, known as the lemon oil, by a process of distillation. Thus it is an Industry that profitably goes along with cultivation of fruit; and it is interesting to note that in East Khandesh, (Bombay province), one Mr. Manekchand Kisandas has been able to get the product. The essence can also be taken out of the pruned branches and twigs after the fruit is harvested and it has been estimated by Mr. J. N. Rakshit in his Laboratories in U.P. that 4 oz. of lemon oil can be obtained from five lemon trees. One tree would give 1 oz. of lemon oil plus 160 pounds of limes per year. It will, therefore, be seen that wherever Kagdi lime plantations exist, this subsidiary industry can very well fit in and should be encouraged. Among the flowers, the roses and Jasmine are the important sources and yield very sweet perfumes. Jasmine buds contain, immediately after opening, obout 80% of moisture and 16.21% of non-volatile matter which goes to form the scent. Among other trees, the Rakshit Laboratory is preparing good essential oils out of the Ocimum Sanctum and other varieties of Tulsi. Mysore and Malabar have developed an Industry of distilling Sandalwood Oil; if Ceylon gets the Cinnamon oil from the barks or leaves of Cinnamon trees and Eucalyptus oil from the Eucalyptus trees we ought to be able to develop this Industry in India also. Eucalyptus oil is an Industry on the Nilgiris. Compounding of perfume is a great art and blending of the same is a great technique. It is necessary that the Government and Universities should encourage research in this line, so that it may be possible to get the Perfumes at a small cost and to compete with the foreign products. The distillation of the Lemon Oil, the Cinnamon oil, the Eucalyptus oil, and Perfumes of the Rose and Jasmine are Industries that fit in easily with Horticulture; and if the Industries are taken up, they may provide a substantial income to the farmer to raise his standard of living. The educated youth can find a great scope in this industry. It is recommended that Government may survey such areas and initiate research and give a lead. The research may be conducted in Science Colleges and at the Horticultural Stations. The bottles of suitable size are required for packing the perfumes and glass factories may be encouraged to produce bottles of the required size and shape.

Gulkand: Gulkand is prepared out of rose petals in combination with sugar. The preparation, being comparatively an easier job, is practised, more or less as a Home Industry, in every Province wherever roses are cultivated. It has, however, a great scope in hotter parts of India, where it is considered to be of medicinal value. It is necessary to work out the exact proportion of the ingredients of Gulkand, so that it may be uniform and of standard quality. Care should be taken to pack it well. It is a very handy industry and should be taken up almost in every rose garden. It can be used for household consumption and also for sending to places where roses are not in cultivation. It must be noted that Gulkand will probably have no export to foreign markets.

Apiculture: Honey is known in India from times immemorial as a valuable product of the Nature and is used for medicinal purposes and yet pure honey is a rarity. It is not that the sources are diminishing, but that the technique of bee-keeping and extraction of honey are not improved upon. A lot of research and improvement has been made in America.

Bee-keeping or Apiculture is an Industry that is worth-while being taken up in orchards, because, as is wellknown; the bees collect the honey out of the flowers The honey flows in Spring and Summer on the plains and in October-November and March-April on the hills. The present practice is to collect whatever honeycombs are prepared naturally, then squeeze out the honey with the result that the bees get crushed and the honey gets fermented like Jaggery.

Fruit Orchards and Flower Gardens are best suited for starting this Industry. Bees help pollination of fruit too and hence are beneficial. Of the Indian bees only Apis Indcia is suitable as Hive-Bee. The other Indian species, namely, Rock. Bee, and Little-Bee, cannot be made to produce honey in hives as they are fond of open air. In India, they use log-hives in South India, cavities in trees and rocks in Kalsa hills, oblong nitches in the walls in the Himalayas, and ordinary pitchers, turned upside down, in Coorg and Mahableshwar.· The methods of smoking, cutting out the comb and squeezing the honey are despicable. There are the professional beemen by name Koeris in Pusa; and the honey produced in Darjeeling Jail is very highly prized because of its purity.

Honey is considered to be an important vehicle in Ayurvedic Medicine and also from the point of view of diet, especially for children and therefore, it has a great value, and there is adequate demand. Besides, it is truly a subsidiary industry that requires no elaborate equipment. What is required is the purchase of a few devices in order to improve the culture of bees and extraction of honey. The requirements for the imprevoment are:—

1. Movable bar frame hive;
2. Honey extracting machine;
3. Artificial Comb Foundation; and
4. The Queen Excluder.

The whole outfit costs about Rs. 22/- and by reason of the mere improvement, the yield of honey can be almost doubled. Each hive would, yield five to six pounds of honey and good honey fetches Re. 1/- per lb. One orchardist with about ten acres can easily manage 10 to 12 hives and even under average conditions can earn Rs. 60/- to Rs. 75/- per annum. There is great scope for this to be taken up, specially near the hills.

As in all other matters, it is necessary that Government should carry on research and introduce improvements, from time to time, and every fruit experimental station must have a bee culture section. Work in South India has shown that pasturage is necessary for success in Apiculture. The Punjab Agricultural Department has started two bee-farms with facilities for training. The Bombay Government also have started a bee-culture station in Poona.

Sericulture

Silk Industry is another cottage industry that fits in very well with Horticulture. As is well known, windbreaks are essential in fruit plantations and mulberry forms a very good windbreak. Silk Industry was in vogue for Many years in Bengal, but the Industry there has now declined. Kashmir and Mysore are the two other tracts where the industry is carried on a fairly big scale. But looking to the world production, of 4,00,000 000 lbs. silk in 1928-29 and the Indian production of 24,00,000 lbs, one feels that India should take a greater share in the worlds trade. Of the total world production, America consumes nearly 73% and Japan alone supplies 90% of this requirement. In Japan, the industry has received great attention and Russia took neasures to develop the industry as a part of the five-year plan. England, France and Italy also have done a great deal to investigate and improve the Industry.

Of the many varieties of Mulberry leaves which form the food of the silk worms, Morus Alba is an important variety and grows in any part of India. The silk worms thrive at a temperature of 65° to 75° F. and humidity of 70 to 80%. The greatest difficulty is about the disease of the worms, the disease being known as Pebrine.

Having stated that the silk industry is a purely cottage industry, that can be taken up in orchards where it is essential to have windbreaks, it is interesting to know that 25 maunds of mulberry leaves are enough to produce one maund of raw cocoons. The subsidiary industry would go as far as the raw silk industry only is concerned. The manufacturing and reeling part of the industry should be left to the silk manufacturers. The raw silk part of the industry comprises the :—

1. Cultivation of mulberry;
2. Production of eggs;
3. Rearing of worms; and
4. Reeling of cocoons in to raw silk.

But, as said already, the supply of eggs should be from the disease-free source.

The requirements of the industry, therefore, are that mulberry should be grown as independent bush or big plantations or as wind-break, the other requirements being the Bamboo frame work, trays, nets, spinning trays, knives and disinfecting materials such as copper-sulphate and sulphur. The Industry is so important that a National Plan should be prepared for the rearing of these cocoons in all orchards by granting small loans, whenever required. The scientific aspect may be tackled in fruit stations all over the country and in the technological branches of the Universities. As in Japan, it may be also necessary to pass laws regarding the purity of silk worms.

This industry, apart from giving employment, may bring in national wealth and thus increase the per capita income.

Papain, Chickle & Luffa Fibre:— Apart from these subsidiary industries, investigations on the use of Galka (Luffa) for fibre, Chickle from Chikus and Papain from Papayas should be taken up, wherever possible. The possibilities of development of Luffa fibre industry seem to be great as has been noticed from preliminary observations made at Poona. Japan exports Luffa fibre to the value of approximately Rs. 1,000,000/- per annum. Chickle extraction also would be a we can chalk out improvements every year, so that at the end of ten years, we can achieve the goal. What is required is a bold policy and a continuity of programme in an optimistic spirit. The programme of work is indicated in the subjoined table. Appendix I.

The main lines of improvements have been dealt with in the various chapters, but the most outstanding recommendations will be enumerated once again, to emphasize the same.

Markets: The first and foremost item will be the improvement of markets, both inter-Provincial and international. There are fruits and vegetables that are grown in particular localities only, and thay can very well find markets in the other provinces. There is also scope for opening up of new markets near big cities and in this the Municipalities can take a great part to their own profit and to the advantages of the grower and the consumer. As regards foreign markets, there are certain fruits, such as the mango, which can have a monopoly, and it is necessary to build up foreign trade with the help of Trade Commissioners, stationed in foreign countries. Regulated Market Acts for internal markets will be found essential.

Horticultural Teaching in Agricultural Colleges

The Agricultural Colleges should give importance to the teaching of horticulture as a major subject and the Indian Universities should see that the education imparted in the Colleges is equal to the education imparted in English, American, French and German Universities, so that for mere ordinary purposes, it should not be essential for our men to depend upon foreign universities for the required training. It is only for very highly specialised training that they should feel the necessity of going abroad. Such fully equipped youths should be induced to go to the villages and colonise there and take up horticulture as a profession. Adult classes and small shows should be held in the villages from the point of view of educating the farmers.

Complete Horticultural Research Stations.

Every province in India must have a complete Horticultural Research Station, where cultural, varietal, manurial, irrigational and other problems concerned with the control of pests and diseases should be tackled fully in a co-ordinated manner. Research, in fact, is the life-blood of all progress and must be given its due place. Besides this research, every horticultural station must carry on investigations in Apiculture, Sericulture, distillation of essential oils especially the lemon oil, the preparation of perfumes and the manufacture of Gulkund, as these fit in well with horticulture as subsidiary industries. The staff of these gardens should be selected with due consideration of individual merit. There should be a few sub-stations affiliated to this station to apply the results of these researches to local conditions. The Universities should also encourage the grant of degrees by investigation into some of these problems. Besides, provincial research and propaganda officers should be given enough opportunity to work in close contact with one another, under a system of central co-ordination for which a full fledged horticultural station should be created at Delhi.

Research in Subsidiary Industries

It is necessary to carry on laboratory research in connection with the subsidiary industries such as canning, and preservation of fruit, juices and vegetables, distillation of essential oils and perfumes, preparation of Gulkund and manufacture of Vinegar from rejected fruit. This will necessitate the establishment of horticultural laboratories in each province.

Arboriculture

In our country-sides we find a good deal of area lying waste and uncultivated and this can suitably be put under vegetation. Arboriculture, viz,. planting of shade trees and other trees of economic importance may be undertaken in these places and the planting may be done by mass effort on a suitable day in the monsoon. This will give fuel and conserve the cow dung and also give leaf mould, so essential in Horticulture.

Cultivation of Medicinal Plants.

An effort may be made to grow important medicinal plants on the farms with a view to study the economics of producing the required plants. All seeds of medicinal plants from forest areas may be collected and grown under the guidance of medical authorities.

Acknowledgements.

The Sub-Committee gratefully acknowledges the information supplied by the Departments of Agriculture, Madras. Bengal, Punjab, United Provinces and Assam. They also acknowledge, with thanks, the information furnished by the Department of Agriculture, Baroda, the Secretary of the District Rural Development Board, Ahmedabad and Messrs. K. C. Naik of Madras, S. S. Bhat of Baroda and N. R. Patwardhan (Vaidya) of Sirsi, Bombay Province. The Sub-Committee, however, wish to record that though the questionnaire was circulated to all the Provincial Governments, States, and some individuals, they could not get response from all the sources.

We feel that if all the work is parcelled out as given in the enclosed ten years' programme and carried on persistently from year to year, Horticulture will help a great deal in the improvement of our villages, the villagers and the nation as a whole.

APPENDIX I

Ten Year Programme of Horticultural Development from 1940.

	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Chapter Nos.	Recommendation Nos.	Recommendation No.s	Recommendation Nos.	Recommendation Nos.	Recommendation Nos.	Recommendation Nos.	Recommendation Nos.	Recommendation Nos.	Recommendation Nos.	Recommendation Nos.
II	1,3,4,	1,3,4,5	1,3,4,5,7	5,6,7	5,6,7,	2,7	2,7,8	7,8	7,8	7,8
III	1,3,12.13	1,2,3,12 13,15	3,4,5,11, 12 13,15, 18,21, 23,24.	3,4,5,11, 12,13,15, 18,19,21, 23,24	10,11,12 13,15,17, 18,19,21, 22,23,24,	8,9,10,11 14,15,17, 18,19,21, 22,	8,9,10,14, 15,16,17, 19,22,	6,7 14,16, 17,20,22	6,7,14,16, 20 22	6,7,14,16, 20,22
IV	1,2,7,8,	1,2,7,8,	1.2,7,8,	1,2,3,7,8.	1,2,3,8	3,4,5,6	3,4,5,6,9	3,4,5,6,9	4,5,6,9	4,5,6,9
V	1	1,2,5	1,2,4,5	1,2,3,4,5,	1,2,3,4,5	1,2,3,4,5	3.4,5	3,4,5	3,4,5	3,4,5
VI	1	1	1	1	1	2	2	2	2	2

APPENDIX II.

IMPORTANT FRUIT CROPS GROWN IN THE VARIOUS PROVINCES IN INDIA:

1. *Bombay and Sind*	Mango Mosambi, Santra, Kagadi Lime, Banana, Fig, Grapes, Papaya, Bor, Cashew-nut, Chiku, Pummelo and Strawberry (at Mahableshwar)
2. *Madras*	Mango, Orange, Limes, Banana, Grape, Pears, Pine-apples, Cashew-nut, Strawberry (in Nilgiries).
3. *Bengal*	Pine-apple, Banana, Mango, Jack fruit, Litchi, Guava, Pummelo and Custard apple.
4. *Central Provinces*	Oranges, Bananas.
5. *United Provinces*	Apple, Strawberry, Mango, Loquat, Litchis, Papayas, Cherries, Apricots, Peaches, Pine-apple, Guava, Gooseberry, Pears and Plums, Custard-apples.
6. *Punjab*	Oranges (Malta and Santra), sweet lime, Kagadi lime, Peaches, Mangoes, Pomegranates, Phalsa, Bor, Plums Guavas, Loquats, Dates, Apples and Pears in Hilly Tracts.
7. *Bihar & Orissa*	Mango, Litchis.
8. *Assam*	Pine-apple, Oranges, Mangoes, Jack fruit, Banana, Papayas, Guavas, Bor and Naspati (in Shillong).
9. *N. W. F. P.*	Grape, Peaches, Apricot, Plums, Quince, Pears, Oranges, and Sweet limes.

10. *Kashmir*	Apples, Pears, Cherries, Plums, Apricots.
11. *Baluchistan*	Grapes, Peaches, Apricot, Plums and Melon.
12. *Hyderabad Deccan*	Oranges, Grapes.
13. *Mysore*	Apples, Grapes, Mango and Banana
14. *Travancore*	Banana, Pine-apple.
15. *Baroda.*	Mango, Chiku, Pine-apple, Bananas Bor, Guava, and Papayas.

APPENDIX III

QUESTIONNAIRE BY THE SUB-COMMITTEE ON HORTICULTURE

(a) Market, Gardening, Cultivation of fruits, vegetables and flowers :

1. Is market gardening practised in your part of the country? What are the crops-fruits, vegetables, and flowers grown for the market? Within what distances from the market are such gardens located ? (market gardening is the form of intensive cultivation of vegetables, etc., designed for definite local markets. This type of cultivation has been a great industry in the Thames Valley for generations. Chinese and French market gardening are well known.)

2. What is the approximate acreage of fruits, vegetables, and flowers under market gardening near each township in your Province ?

3. What is the population that specially favours market gardening? Who are the customers generally for such produce ?

4. What are the usual and out-of-season crops included in the market gardening in your tract? What is the approximate cost of cultivation per acre for some of these crops included in market gardening ?

5. Can you define a tract in your Province as being the most suitable for market gardening, and if so, what in your opinion are the factors that encourage market gardening ?

6. What part do vegetables have in the normal diet in your part of the country? Does it need to be increased? If so, what steps would you adopt for effecting this increase ?

7. What are the conditions of irrigation and supply of manure in your tract, where market gardening is practised ? Please state whether sewage is being utilised anywhere as a source of manure in market gardening.

8. Is there any chance of allotment gardening being popularised in any town in your tract ? (Allotment gardening

is that sort of skilful cultivation which aims at the production of food on a particular allotment, specially from the point of selfsufficiency of exhibitions.)

9. What are the arrangements for the supply of plants and seeds? Are there any reliable nurserymen and seedsmen, and if so, what is their extent of business ?

10. Please supply information in the following form :—

1, Name of Town with population.	2, Kind of vegetables & flowers grown.	3, Total acreage	4, Average holding

5, Total No. of hands engaged	6, Total production in weight.	7, Total income	8, Wages of labourers.	9, Value of land.

11. Are any difficulties experienced in the way of transport and marketing of fruits, vegetables and flowers ? What are the new local markets that have developed during the last ten years and if this has given an impetus to market gardening in particular and the horticulture in general ?

12. Will cheap transport facilities, proper advertisement and grouping of crops, according to local soil and climatic conditions be helpful to development of Horticulture ? Are there any fruit, vegetable and flower co-operative sale societies in your tract, and if so, how far have they given an impetus to market gardening ?

13. Is there any attempt made for the production of seeds of indigenous vegetables and flowers ?

14. What are the fruits generally grown in your part of the country ? How much area is allotted to fruit cultivation ? Is there any further area in the Province or the State which, in your opinion, can be profitably employed for fruit cultivation ? What is the economic value of this cultivation in your Province ? Is it paying ?

15. What jungle fruits do you think can be taken up of breeding and cultivation? Have any such attempts been made in your Province?

16. Do people eat fruits to a large extent in your part for the country? To what extent are they consumed within the Province and how are they exported to other provinces in India or to outside countries?

17. What are the difficulties experienced by the fruit growers in your province? What are the special difficulties peculiar to particular crops?

18. What are the factors which in your opinion govern extension of fruit and vegetable cultivation in your tract? Some of the following may be considered in this regard:—

Import and export, quality, cultural problems, grading, packing, transport, storage facilities, pests and diseases, co-operative sale societies, co-operative farming. Frequency of periodic failure of crops, collection of statistics. Utilisation of bye-products of Horticulture.

What special facilities are required in your Province for extension of fruit cultivation?

19. What is the proportion of fruit—fresh and tinned, in the usual diet in your part of the country? To what extent does it need to be improved? How would you suggest this objective to be achieved?

20. What is the total production of fruits and vegetables in India and how does it compare with the per head production of fruit in the diet?

21. Could you mention any special features of (a) fruit cultivation, distinguishing between several kinds of fruits, and (b) fruit trade, distinguishing between trade within the provinces and trade with foreign countries which demands special attention, requires special arrangement and protection and other assistance?

22. What arrangements are available or would you suggest for the satisfactory transport of fruits over long distances and

for the proper storage in order to aid in their profitable marketting? If there are any, mention some.

23. How does the cultivation of fruits and development of the industry in your part of the country compare with the corresponding cultivation or industry in other provinces or foreign countries ? What is the explanation in your opinion for the difference ?

24. What is your idea of the capital required for intensive cultivation of fruits, vegetables and flowers ? What are the present sources of finance?

25. What is the incidence of frost bazard in your tract and how far does it hamper cultivation of fruits and vegetables ?

26. What are the important pests and diseases on fruit, vegetables, and flowers in your tract ? What is the extent of damage caused ? Please give details if possible ?

(b) Methods of Fruit Preservation :—

27. Is there any industry founded on fruits as raw material whether large scale or small scale, for the preparation of pickles, preserves, dried or canned fruits or confectionary ? Please give an estimate regarding the annual output and value, of such industrial concerns ?

28. What scope is there in your part of the country for the extension and development of the fruit preservation, canning, pickling, salting of fruits as also for soups, jams, jellies, marmalades, juices, syrups, sherbats, etc., prepared from fruits ? Is vinegar manufactured in your tract and if so what fruits are used in the preparation of vinegar ? What do you consider to be the most economic units for such industry in your part of the country ? Please supply the information in the following form :—

Name of town	Fruit, vegetables etc, preserved canned, dried, etc.	Quantity & value of fruit preserved	Name of Manufacturer.

29. Which are the preserved or dried fruits that are exported out of India from your tract ?

(c) Other Subsidiary Industries

30. What is the consumption of essential oils in your part of the country ? How is it supplied, whether from local sources or by import from outside the provinces or from outside the country ? If such essential oil industry is dead in your locality, please state how you propose to revive it ?

31. What other toilet accessories or aids to beauty could you obtain from a systematic cultivation of flowers and organisation of industry based thereon ? What are the imports in your tract, from other parts of India as well as from other countries, of such articles made out of flowers ?

32. Are any essential oils or attars or rose water or gulkand prepared from flowers in your tract ? Are lemon oil and citric acid manufactured to any extent for export outside India ? If so, give the idea of total production and the market ? Please supply the information in the following form :—

Name of town.	Kind of scent prepared and used. Give name of flower, seed or peel.	Extent of Manufacture	Principal manufacturer.

33. What are the flowers, principally grown in your part of the country for the market? Can you give some idea of the yield, both quantitatively and by value, of the flowers grown in your tract? What is the area under flowers? Where are the seeds obtained from? Cannot the seeds be produced locally ? What are the difficulties in the production of seeds?

34. What special effort is noticed in your part of the country to show that systematic and effective attention is paid to the economic and profitable cultivation of flowers? What improvements would you suggest in this connection?

35. What are the objects for which flowers are commonly used in your part of the country? What scope is there in your opinion for the extension of flower cultivation?

36. To what extent is the growth of wild flowers capable of systematic organisation and developments ? Can you furnish any information or statistics regarding the uses of wild flowers

in your part of the country and their possibilites for scientific and economic use? Name wild flowers on which breeding work will be profitable.

37. What are the industries connected with flowers, large or small in your part of the country? Please furnish all the information you can regarding the output in quantity and value.

38 What scope is there in your province for the development of flower industries, particularly for the making of essential oils from flowers, leaves, bark and fruits, etc., scents and attars?

39. What is the most economic unit for the building up of such industries in your part of the country as regards size, operations etc?

40. How far is it possible to obtain industrial alcohol from wild fruits and flowers in your part of the country? What ways and means would you suggest to make an economic and profitable use of these materials?

41. What in your opinion would be the amount of capital needed for the establishment and proper equipment of modern industries founded on fruits and flowers and other parts of the plants as raw materials and producing for the local, national and international markets?

(d) General

42. Are there any special problems in your part of the country relating to labour in fruit plantations or canning factories? To what extent if any, is labour unrest prevailing in this branch of national economy? Are there any arrangements for the continued maintenance of industrial peace in this regard? If so what degree of success has attended them in practice?

43. What steps would you suggest should be adopted by Government or other authorities concerned for the development of economic or scientific research needed for an adequate development of fruit cultivation in different parts of the coun-

try, for its effective marketing and for the establishment and development of industries founded on fruit cultivation?

44. In a carefully planned economy affecting the entire country would you consider it proper that any given region or regions should specialise exclusively in particular kinds of fruit and industry founded thereon? If not, on what lines would you suggest should the cultivation of particular fruits, or specific industries founded on fruit, be distributed in the comprehensive planned economy of India?

45. Are Horticultural, Floricultural, or Industrial shows held in your tract? If so what is their effect on industry?

46. Are any horticultural classes held in your tract by Government and if so, what is the effect? Do people as a result take up improvements and start the industry?

47. Have educated men taken to Horticulture as a profession and if so can you name instances of successes or failures?

48. What are the present agencies for the dissemination of expert knowledge in horticulture in your tract and how far are they appreciated?

49. Name the experimental stations doing work on fruit, vegetables and flowers or in the preservation of fruit, etc. in your tract.

(a) What are the problems in hand?

(b) What are the problems that have been solved so far?

(c) Have any problems taken in band been abandoned half way, and if so, why?

50. Have the railways in your tract given any freight concessions on fruits, flowers, and vegetables and what is the effect on production?

51. Is Arboriculture practised in your tract? What are the trees planted and in what areas are they planted?

52. Are there any research laboratories—private or of Government or of Universities, where research on distillation on scents, canning and preservation of fruits or utilisation of forest produce is carried on? If so, what are the results obtained?

53. What are the medicinal herbs or plants to be found in your part of the country? What steps, if any, have been taken to develop the cultivation and scientific treatment of such herbs and plants so as to make them minister to public health? What are the handicaps, in your opinion, for the full and proper development, of this industry? How would you remove them?

(a) Is there any one in your tract growing the medicinal plants for sale and if so, what is the magnitude of business?

(b) Are any medicinal plants imported in your tract and if so, to what extent?

(c) Can you give a list of medicinal plants grown in your tract?

(d) Can you give an idea as to the root, foliage, flower or seed of any medicinal plants required for use in your tract?

(e) Could you give the names of popular medicinal plants and the use to which they are put?

54. Do you think keeping model gardens, containing economic trees, plants and grasses attached to primary, secondary and high schools being systematically worked by students, will popularise and familiarise Horticulture in India? Any suggestions please?

Resolutions of the National Planning Committee On the Report of the Sub Committee for Horticulture.

The Final Report of the Sub-Committee on Horticulture was presented by Mr. Jabir Ali, Secretary of the Sub-Committee on the 14th May 1940. Dr. G. S. Cheema, Chairman of the Sub-Committee, was unable to be present. Discussion concluded on the same day. The following resolutions were adopted:—

1, The National Planning Committee having considered the Report of the Sub-Committee on Horticulture, record their general agreement with the recommendations made therein. The Committee are of opinion that the present consumption of fruit and green vegetables in India is very low and infrequent, which affects the health of the people considerably. It is necessary, therefore, to increase this consumption, as a part of the regular diet of the people, to such a degree as may be deemed adequate by nutrition experts. For this purpose the people should be educated and encouraged to consume more fruit and green vagetables. The following measures are calculated to achieve this object and are accordingly recommended:—

(i) protecting the fruit grower in India by levying adequate duties on imported fruit;

(ii) to set apart sufficient areas of land for the purpose of developing fruit cultivation;

(iii) providing cold or other forms of storage (e. g. gas) in markets as well as during transport;

(iv) adjusting internal transport rates so that they are in keeping with the ability of the fruit grower and the consumer;

(v) extending the system of regulated markets to the trade in fruit;

(vi) encouraging the cultivation of fruits and vegetables for personal use;

(vii) encouraging, after the local and Indian market has been fully supplied, the export of surplus fruit, or fruit which is the monopoly or speciality of India.

2. Horticulture should be treated as an integral subject in the curricula of agricultural colleges and the Universities, and facilities should be offered for specialised post-graduate study. A Central Horticultural Institute should be established in a suitable place to promote research. This research shall include the question of introducing suitable foreign plants in India and also the development of all seeds required for growing flowers and vegetables, and for medicinal plants, as well as in modern methods of storage.

3. Market gardening for vegetables and flowers should be extended and developed and the industry consisting of the making of essences, attars, oils, etc. should be encouraged to meet progressively the demand of the Indian market.

4. Other industries connected with horticulture e. g. agriculture, sericulture, etc. should also be established or encouraged.

SUMMARY OF DEVELOPMENTS

As the Report of the Sub-Committee shows, public attention is being increasingly drawn upon the potentialities of this source of new wealth in the country. The consideration shown to it is as much from purely diatectic as from the industrial standpoint.

Owing, however, to the War, and the great political changes happening thereafter, planned programme has not yet been put into operation anywhere. No systematic attention has therefore been devoted to this item and aspect of planned economy. No progress has, accordingly, been made in extending the area under fruits and vegetables which needs to be increased at least 100% in volume, not-withstanding the intense campaign for "Grow More Food".

In several of the Provincial Plans, however, and particularly in their sections devoted to the benefit and settlement of the ex-Servicemen, schemes have been put forward to allot culturable waste (or fallow) land to ex-soldiers and sailors for settling them and their families there and enabling them to grow fruits and vegetables or carry on market-gardening in general. In these colonies some of the settlers may develop the industries founded on fruits and vegetables as raw materials, canning and preserves on a cottage or large scale. If these items of the Provincial Plans are properly carried out as proposed, considerable addition would be made to the area under fruits and vegetables; and the new wealth derived from this source, as also from the industries based thereon, will be more than proportionately increased. For on this practically new land, and new industries, all possible economies can be made, all the modern machinery and labour-saving devices employed, and intensive cultivation made the order of the day on such units of cultivation, or production as are found the most economic.

Other developments, e. g. in regard to the Cold Storage of these perishable goods, and their effective transport over long distances, also remain to be achieved. The War is responsible, in this as in other fields for arresting the progress of developments. But they can no longer be deferred; and when effected, they would add materially to the sum total of our national wealth. The Fruit Canning Industry, however, has made some progress in the last few years; and plans are afoot for a greater extension of that industry in many places on a factory scale. As remarked in the Introduction, wherever the industry, or extension of Horticulture for production of raw materials or foodstuffs is on a new field, and where, consequently, there are no vested interests to bar the way, the new ventures must be owned and controlled by the State, or its representative i. e. some Local Body, like a Municipality or a District Board, or a specially set up Statutory Authority. A Local Body like a Municipality would be the best for this enterprise, as it will not only have the necessary knowledge and experience; but also be able effectively to supervise operations, which any other agency might not be able to do. Besides a Local Body might be interested also as immediate consumers of fruits and vegetables, essential oils, drugs or medicines, toilet preparations and other like articles made out of these materials; and as such their interest would be much closer in the success of this enterprise.

The parallel and simultaneous working of Private and Public Enterprise in a common field would be productive of hardship to both and embarrassment or obstacles. But, if, as suggested in another Volume in this Series, dealing with the reorganisation of the entire Agrarian Economy of India, including Land Tenure, the Plan changes the present order into a universal Cooperative System, all such difficulties, handicaps or obstacles would be largely obviated.

Meanwhile, Researches are going on, not only at the Nutrition Institute, regarding the food-value of fruits and vegetables; but also in marketing, storage, grading and transport facilities. The Forests Institute studies the possibilities of production and development of Drugs and Medicines. For taking full advantage of all these, the new marketing machinery slowly growing up in particular products, will have to be much more generalised, and made integral part of the Plan, so that all items entering into market from any side would be properly attended to in regard to their prices, transport, storing, grading and all other factors bearing on proper disposal of the commodity; and so improving the prospects of the entire enterprise. If the plan is carried out as outlined above, the sum total of our National wealth will be substantially increased.

APPENDIX TO THE SUMMARY OF DEVELOPMENT OF ANIMAL HUSBANDRY

Five-Year Plan for Milk Production in India.
Central Government Move.

A five-year plan is under consideration of the Indian Union Government to improve the quality of cattle and increase milk production in the country, stated Dr. R. Kothavala, Dairy Development Adviser to the Government of India, in an interview.

The scheme may cost Rs. 50 crores which would have to be shared in certain proportion between Central and Provincial Governments and the producers.

Dr. Kothavala said that the Indian Dominion possessed 38 million cattle heads constituting one third of the total cattle population of the world. But the average milk yield per cattle was so low that there was not enough milk to go round. From a nutritional point of view an individual required,16 ounces of milk per day, half the quantity to be cosumed in liquid form and the other half in the shape of milk products. On this basis India's milk production would have to be increased three fold to ensure that everyone got the minimum quota of milk.

So far as Bombay Province was concerned, the per capita consumption of milk per day was less than three ounces, so that the milk production of the Province would have to be increased nearly six times. India's problem was not so much to develop cattle numerically—the country had adequate livestock—but to improve the quality of cattle and also to increase milk yields. This could be secured only by breeding and rearing cattle on scientific lines. For purposes of breeding, the country suffered from the paucity of bulls, the male cattle population being only 500,000. Only five percent of these could be considered good enough for breeding purposes. The country would have to adopt methods of artifical insemination on an increasing scale to accelerate the improvement of cattle.

Dairy Development

The seven point scheme now being considered by the Government of India dealt with the problem of dairy developments in all its aspects. Under the scheme, Provincial Government would be requested to encourage the establishment of milk and bull production farms which would devote as much attention to the production of milk as to rearing bull stock and which would work in conjunction with the milk supply for urban areas. Small land-holders would be encouraged to form milk farms with the assistance of Government. Steps would be taken for the colonisation of dislodged urban cattle, because it generally happened that urban areas maintained cattle solely for the purpose of milk production and despatch them to the slaughter house as soon as they went dry. It had been found that in wet, hilly and extreme climates, inferior cattle had hardly any chance of survival, but cross breed of inferior milk stock produced a hardy type of animal which not only survived but did well in such climates. Centres for this purpose were proposed to be started. Co-operative milk units to encourage, the cultivators and co-opreative creameries in "milk Pockets" far from milk consuming centres, would also be encouraged and steps for increasing the production of fodder for cattle would also be taken.

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